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Determinants Of Innovative Entrepreneurship and The Role Of Policy Interventions

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Summary

Entrepreneurship is an increasingly relevant and popular object of scholarly investigation. In the last two decades, the contribution of entrepreneurship to economic growth and welfare enhancement has been largely established in economic literature, both theoretically (see for example Acs et al., 2008) as well as empirically (Wong et al., 2005). However, a high measured level of entrepreneurship does not directly translate into a high level of economic growth. As highlighted by recent studies, encouraging the creation of new ventures does not enhance economic growth or stimulate job creation, but rather it is about supporting high quality and potential high growth firms to be founded.

The purpose of this doctoral thesis is to deepen current knowledge about the determinants of the entrepreneurial activities success, and the effectiveness of entrepreneurial policy interventions designed to support entrepreneurial activity. In particular, the analysis will be evolved around three distinctive factors that have been identified as potential entrepreneurship success drivers: founders' human capital characteristics, access to financial resources, and access to complementary resources. The investigation's area is broad and the thesis is structured as a collection of three papers. Consequently, each essay addresses a specific topic and follows a unique publication strategy, and in each, there is a specific theoretical framework and the literature review.

Essay A adds to the intersection of the institutional theory and entrepreneurship literature by studying whether an institutional change can facilitate the transition from quantity to quality innovative entrepreneurship. This research paper investigates the effect of a policy intervention including alternative mechanisms - entry and growth barriers, respectively - on founders' human capital, and consequently on the performance of their ventures. Based on a comprehensive sample of founders of Italian innovative startups incorporated before and after a specific entrepreneurship policy intervention issued in 2012 by the Italian government, the results highlight that however entrepreneurship barriers' reduction increases propensity of high human capital individuals to choose the entrepreneurial path, the instruments that reduce growth barriers impact greater than the

removal of entry barriers. In the same vein, the specific rather than the generic human capital components are the most incentivized by the removal of growth barriers. Finally, the empirics highlight the existence of a super-additive effect between the institutional change and founders endowed with specific high human capital on the startups' performance.

This paper contributes to existing literature by showing that lowering barriers to growth rather than barriers to entry has a prominent relevance for entrepreneurship and potential economic and social growth. Besides, the essay also offers relevant implications for policy makers and institutions. First, the empirics suggest that regulators may impact the entrepreneurial quality even in the short term. Second, considering the scarce resources at their disposal, policy makers must prioritize: introducing growth related benefits are potentially the most effective measures in pushing the talented individual towards the innovative entrepreneur's career path. Moreover, not even the reduction of growth barriers incentivizes highly skilled entrepreneurs, but they perform better.

Essay B looks at the problem of recruitment for innovative startups during the early stages. In particular, the empirical study analyses the relationship between startups founders' characteristics and the presence of non-founding employees. The key insights are that opportunity-driven entrepreneurs endowed with previous entrepreneurial experience are more likely to hire in the early stages, especially in the high-intensity context. Furthermore, it comes out a positive sorting between entrepreneurs endowed with better human capital and high-skilled employees. This study contributes to the recent literature streams related to startup's antecedents in the hiring process by assessing the role of founders' human capital characteristics and entrepreneurial motivations for the startups' attractiveness in the eyes of talented candidates. This essay provides a more nuanced view of the resourced based-perspective in entrepreneurial settings. In particular, it builds on extensive contributions highlighting the importance of human capital for startup success by investigating a specific channel through which entrepreneurs can achieve high performance: by attracting and retaining the best talent in a timely manner.

These results have important implications for the theoretical understanding of the hiring decision in the entrepreneurial context. In particular, a great deal of talent acquisition success appears to be dependent on the entrepreneurial team's characteristics. They also have practical – and even policy - implications. First, they align with recent policy interventions which aim to promote the creation of startups by experienced and highly skilled individuals, who are often believed to have better survival and growth chances. Second, these findings have further implications for the formation of entrepreneurial teams. The complementarities between different measures of human capital seem to be important in attracting highly-skilled non-founding employees since a combination of founders with specific entrepreneurial experience and founders with high education attainment might help startups overcome different challenges in the hiring process.

Essay C analyses the effectiveness and potential interrelations of different policy instruments specifically designed to alleviate the financial constraints common to innovative new ventures. In particular, the study revolves around the interrelationship between a Government-guaranteed (GG) bank loan program and fiscal incentives for venture capital (VC) investments. The results suggest two important facts. First, the two policy measures sustain rather different typologies of Young Innovative Companies (YICs). Specifically, YICs obtaining GG bank loans appear relatively younger and smaller than those ventures invested by subsidized VCs. In other words, a sort of "institutional division of labour" seems to be in place between the two measures. Second, once a VC investment is received, an IYC becomes even less likely to seek a GG bank loan. Overall, the analysis depicts what in the essay is labelled as a Task segmentation effect.

These findings have interesting implications in the realm of the public activities' role in the entrepreneurial finance market. First, a comprehensive policy mechanism that encompasses different instruments designed to enhance access to external financial resources does not present serious cannibalization risks and crowding-out effects. Second, the GG fund entails a significant reduction for bankers of the effects of type 1 risk (lending to failure business), encouraging them to grant loans also

to the younger and smaller YICs. On the other hand, the equity investments' fiscal reduction did not seem to have produced shifts in the VC investments' target, however surely contributed to increasing the number of VC investments in the weak continental European VC market. Third, these results clearly show how policy complementarity in the domain of financial support to innovative entrepreneurship is difficult to achieve.

Through diverse theories and methodologies, the dissertation provides empirical support to the role perceptions play during the entrepreneurship process and suggests rhetorical strategies entrepreneurs can exploit to gather resources and achieve competitive advantage.

1. Introduction

Over the past two decades, innovation and entrepreneurial activity are topics that have received a great deal of attention in scholarly literature. Startups and Young Innovative Companies (YICs), especially those operating in the technologically advanced sectors, have attracted the interest of scholars, policy makers and also of other important actors of the modern economies.

Since Schumpeter's seminal work (1912), innovative entrepreneurship is deemed to be a major source of innovation, qualified employment and economic growth, and a large body of the following literature has enlarged the knowledge about this specific type of firm. Indeed, startups are typically characterized by their ability to develop and transform technical innovation into innovative products and services. They can stimulate the rise of new technological paradigms, and they can also influence the strategies of established leading incumbents, open up new market segments and stimulate the flow of knowledge and competencies within industries (Timmons and Spinelli, 2003; Aghion and Howitt, 2005) and university research (Powers and McDougall, 2005). Moreover, there has been a growing interest on the role of entrepreneurial activity for the economic and social development, and the existing literature has highlighted a positive correlation between entrepreneurial activity and welfare improvement (Audretsch et al., 2006; Carree and Thurik, 2003).

However, the most recent entrepreneurship literature argues that it is not the number of new startups that matter for the enhancement of economic development, but rather than the positive impact is closely tied to high-growing startups (Grilli, 2014). In fact, while earlier literature highlights the key role of entrepreneurial activity for the economic and social development (Audretsch et al., 2006; Carree and Thurik, 2010), these positive impacts are attributable mainly to growth-oriented ventures. As a consequence, over the last decade, a debate had risen among scholars, policy makers, and practitioners around the determinants of new ventures performance, and therefore how institutions and governments can support the rise of high-growing entrepreneurship. Hence, the creation of rapid-growth entrepreneurial ventures represents the main goal of every policy agenda, both in the short-

and in the long-term future. Different instruments have been designed and implemented to create a more favourable environment that can increase not only the level of entrepreneurship but more importantly its quality. Even if a very strong scientific debate has centred on the question of better policy interventions to put in place, scientific literature has not provided comprehensive and clear guidelines on identifying the best mechanisms tailored to each specific institutional context (Taylor, 2016; Wagner and Sternberg, 2004).

In this respect, firms' growth is a complex phenomenon, describable through idiosyncratic factors that are rather complicated to describe and determine (Penrose, 1959). Startups and YICs growths clearly follow a specific set of rules and different scientific lenses and methodologies have been embraced by scholars to analyse the phenomenon. In this perspective, there are several studies that have tried to identify the fundamentals of entrepreneurial growth (Gupta et al., 2013). For example, Grilli (2014) presents a heuristic firm's growth model for New Technology based Firms (NTBs) which frames the causal inputs of growth. In doing so, the author identifies three fundamental building blocks which influence the growth process: knowledge capital, financial resources and complementary assets. Even though there are numerous publications in this field, there is still a dearth of empirical studies on how these firms grow and what the influencing factors are, especially within a specific geographical context that lacks high-growing innovative new ventures.

Relying on extant conceptual and empirical literature on the determinants of high-tech entrepreneurial venture growth, in this thesis I have analysed in a unique institutional setting - i.e. the Italian context - three specific aspects which are universally recognized as critical for innovative new ventures growth: the human capital characteristics of the founding team – essay A ; the role of founders' human capital endowment in attracting talented joiners – essay B ; and the effectiveness of a policy interventions devoted to alleviating YICs' financial constraints – essay C.

As aforementioned, the thesis focuses on an extremely relevant institutional context, i.e. Italy, that similarly to other European countries suffers a serious gap in the ability to generate successful startups

- and consequently social value - toward the U.S. (Grilli and Murtinu, 2014), as well as a structural weakness for what concern the national innovation system (Nuvolari and Vasta, 2015). The element which makes it more interesting for the research scope is the policy intervention that was established by the Italian government in 2012. Law no. 221/2012 (the so-called Italian Startup Act), is a comprehensive policy intervention implemented to facilitate the creation of high-growth oriented new ventures. The target is innovative new ventures, granted by specific incentives, exemptions and access to discounted services like, for example, bureaucratic and administrative simplification (i.e. entry barrier reductions), more flexible labour regulations, "fast fail procedure", fiscal reduction of equity investments and Bank's Government Guarantee mechanisms. The characteristics of the institutional context and the comprehensive policy intervention create the conditions for a wider investigation of entrepreneurial activities and the potential effect of the public intervention.

Starting from the human capital characteristics of the founding team, existing studies drawn on resource-based theory have proved that the positive effects of entrepreneurial activity on economic and social development (e.g. Audretsch, 1995) are strongly linked to the quality of the entrepreneurial team (Beckman et al., 2007, Colombo and Grilli, 2005; 2010; Eisenhardt and Schoonhoven, 1990). Scholars has vastly studied the determinants, at the micro level, of entrepreneurial opportunity discovery, and the results of entrepreneurial activity connected to the human capital characteristics of the entrepreneurs (Ardichvili et al., 2003; Choi and Shepherd, 2004, Colombo and Grilli, 2005; Shane, 2000; DeTienne and Chandler, 2007; Douglas and Shepherd, 2002; Foo, 2011; Lévesque and Minniti, 2007; Van Praag and Cramer, 2001). However, individuals endowed with better human capital have higher opportunity costs in pursuing the entrepreneurial path, mainly because their potential wage as employees is higher than individuals characterized by low levels of human capital. In this context, policy interventions which lower entrepreneurial barriers typically induce higher rates of new venture creation (e.g. Demirguc_Kunt et al., 2006; Klapper et al., 2006), however few empirical studies have analysed how institutional changes impact the characteristics and quality of individuals who found them (e.g. Kwon and Arenius, 2010; Lim et al., 2010; Stephan et al., 2015). Despite the extensive

literature on how lowering entry barriers by shifting regulations induces higher rates of new venture creation, only a few recent studies have tried to disentangle whether reducing barriers to entrepreneurship facilitates a more attractive entrepreneurial environment and hence increases the relative presence of highly qualified founders, who do have lucrative alternatives apart from entrepreneurship. Starting from Eberhart et al. (2017) and Eesley (2016), paper A is built on the idea that institutional changes that reduce different types of barriers – i.e. entry and growth barriers - to entrepreneurship impact not only the quantity of entrepreneurs, but also their entrepreneurial quality in terms of founders' skills and competencies. In fact, the cost of entry may strongly impact individuals endowed with lower human capital, who may lack employment opportunity and therefore establish much lower performance thresholds in order to start the entrepreneurial career. Instead, I hypothesize that highly skilled entrepreneurs could benefit more from the lowering of the growth's costs. Specifically, founders endowed with higher human capital choose to start a new venture based on the perception that an attractive and unexploited business opportunity exists in the market (Acs and Varga, 2005; Arenius and Minniti, 2005; Reynolds et al. 2005). However, this opportunity can effectively translate into superior performances only if access to financial and external complementary resources is not made impervious by the existing institutional environment.

In this respect, structurally lowering the typology of costs which has more to deal with easing the growth of startups should benefit more, in relative terms, the individuals that have higher growth potential in the first place.

In doing so, the essay adds to the extant literature in several aspects. First, the research integrates two different mechanisms through which institutions can influence the attractiveness of entrepreneurship path, i.e. reduction of entry and reduction of growth barriers, within the same institutional reform. Second, the study answers the call to extend the evidence on the relationship between the institutional environment, entrepreneurial entry and high-quality entrepreneurship with two advancements in this perspective. On the one hand, the essay digs into the nature and type of

human capital that is most stimulated by the institutional reform, using the distinction between generic vs specific components. On the other hand, how different types of barriers' reduction impact different types of individuals, overall entrepreneurial performance, as well as their interaction. Third, the study focuses on a specific institutional context, Italy, which suffers an innovation gap at the entrepreneurial level relative to the U.S.

Essay B analyses the relationship between founders' characteristics and the presence of non-founding employees in the startup. As extensively reiterated in the existing literature, for the entrepreneurs it is quite hard to obtain success on their own, being highly reliant on the external human capital resources (Coad et al., 2017; Honorè and Ganco, 2016). In this perspective, the scientific community has recently started to pay increasing attention to startup's employees as key entrepreneurial activity actors contributing to growth too (e.g., Agarwal et al., 2016; Koch et al., 2013; Rocha et al., 2018, Siepel et al., 2017). In particular, researches on innovative entrepreneurship have recently shifted the focus to *joiners* (i.e. employees who decide to join the early stage innovative ventures instead of large established firm), identifying them as a particular group of individuals with a distinct set of characteristics and preferences (Roach and Sauermann, 2015), and relatively overlooked by entrepreneurship scholars. However, while it is universally recognized that external human resources are a key factor for the startups' success, new ventures face severe obstacles in attracting employees compared to large established firms, mainly due to their liability of newness (Freeman et al., 1983; Stinchcombe, 1965) and smallness (Aldrich and Auster, 1986), and their consequent lack of company legitimacy (van Werven et al., 2015). In addition, startups are in a disadvantaged position compared to large incumbent companies also in their ability to offer competitive wages and work conditions (Cardon and Stevens, 2004). For these reasons, new ventures and established firms differ in their recruitment practices and in the quality of attracted employees (Cardon and Tarique, 2008; Carroll et al., 1999). Given these findings, there is a salient need to understand how startups can mitigate these limitations and succeed in hiring. Since the founders are the first architects of the ventures they establish, I posit that the human capital characteristics of the founding team to attract non-founding

employees. Yet, few studies have tried to analyse the potential role of founders in attracting human capital in entrepreneurship research – except for Bublitz et al., 2017; Coad et al., 2017; and Honorè and Ganco, 2016. Paper B contributes first to reduce this research gap by first examining the relationship between the founders' human capital characteristics and motivations of the founding team and the presence of employees. Second, it investigates whether R&D activities moderate these relationships. Third, it contributes to the debate around assortative matching in startup's settings (e.g. Rocha et al., 2018) by analysing the relationship between human capital characteristics of the founders and the quality of the employees.

Essay C analyses the effectiveness and the possible existence of interrelationships between two different policy instruments, namely a Government-guaranteed (GG) bank loan program and fiscal incentives for Venture Capital (VC) investments, introduced by the Italian Startup Act aiming at reducing financial constraints which Young Innovative Companies commonly suffer. As aforementioned, innovative startups suffer from some rather severe limitation concerning external financial resources (Grilli, 2014), and these restrictions are particularly marked in a typical bank-based context as Europe (Revest and Sapio, 2012). As argued by the largest part of the literature innovative entrepreneurship, the lack of financial resources is a serious problem especially for early-stage new ventures, since their success relies on R&D investments, marketing activities to promote and commercialise innovative products, as well as resources to hire qualified personnel (Beck and Demirguc-Kunt, 2006). Based on financial literacy, there are two main reasons to explain the gap between the demand for external financial investments by the innovative startups and the investors. First, problems that derive from knowledge spillovers in innovative activities (Nelson, 1959; Arrow, 1962; Teece, 1986; Hall and Lerner, 2010), which may hamper innovative new ventures that suffer from inefficient mechanisms of protection of their investments in research activities. Second, bankers and venture capitalists suffer the problem of information asymmetry when assessing lending applications or during the equity investment evaluation process (Binks and Ennew, 1997; Carpenter and Petersen, 2002; Revest and Sapio, 2012). From a long time, policy makers have designed and

implemented several types of interventions in order to alleviate the financial constraints of YICs. However, if there is a general consensus among both academics and policy makers on the need of these institutional interventions, there is much less agreement on the subsequent question of which policy to put in place (e.g. see Schneider and Veughelers, 2010). Different governments have opted for different policy interventions on the grounds that specific instruments should be designed for specific institutional contexts to be truly effective (Wagner and Sternberg, 2004). However, despite a vast literature on the effectiveness of entrepreneurship policy (Storey, 2003), many aspects about the efficacy of these instruments are yet to be fully explored (Minniti, 2008). In this respect, there is a salient need to better understand which typology of innovative ventures get access to which type of policy measures, for then gauging the eventual synergistic effects potentially stemming from the co-existence of different public policy measures available. Equally important, the analysis should be performed in a controlled institutional setting. In other terms, the circumstance that YICs are embedded in different context and are potentially the target of different policy interventions has been widely overlooked in the entrepreneurship literature (see for example Grilli et al., 2018). Thanks to the Italian Startup Act, I was able to observe a context where all the "innovative startups" are potentially subjected with the same degree of exposure towards an equity program that envisages fiscal incentives for venture capitalists and privileged access to a Government-guaranteed (GG) bank loan program. Thus, there were the conditions to properly investigate the mutual interdependencies arising between the two different sources of financing – and the underlying policy mechanisms. In particular, essay C answers the following research questions: do these measures target similar YICs? Can these measures be considered complementary, or conversely substitute? Is there any signalling effect?

With the aim to spread the works within the academic community, three scientific articles were submitted to different scientific journals and all the articles presented in this dissertation are currently in the pipeline. In particular, paper A, entitled "Do The Rules Of The Game Determine Who Is Playing? Institutional Change, Entrepreneurship and Human Capital" has received a Revise and Resubmit from

Organization Science. Paper C entitled "Entrepreneurship Policy and The Financing Of Young Innovative Companies: Evidence From the Italian Startup Act" has received a second Revise and Resubmit from *Research Policy* and the new version of the manuscript will be resubmitted on May, 4th 2019. Paper B entitled "We're Hiring! Entrepreneur Characteristics and Talent Sorting In Innovative Startups" is the most recent study and it will be submitted to *Journal of Business Venturing*. Table 1 lists the papers, indicating co-authors and their status.

In order to improve the quality of the studies and disseminate this work within the academic community, the studies have been presented to several national and international conferences. In particular, also thanks to all the comments received during the last two years and the work to face them, paper C won the Best Paper Award from among more than 400 studies which presented to the 2018 R&D Management Conference, in Milan in July 2018.

The main goal of this cover essay is to provide an overview of the main features that will be analysed in detail in the appended article. Therefore, after Section 2 which contextualizes the research gap and the research questions, Section 3 provides an explanation regarding methodology and the uniqueness of the context of analysis. Section 4 summarises the main results of the three papers included in this thesis. Section 5 highlights the main contributions for researchers, practitioners and policy makers. Finally, Section 6 addresses the limitations of the analysis.

Table 1. Articles structure and status

Paper	Title	Co-authors	Journal	Status
A	Do The Rules Of The Game Determine Who Is Playing? Institutional Change, Entrepreneurship and Human Capital	Boris Mrkajic *Politecnico di Milano – Pwc Denmark* Luca Grilli *Politecnico di Milano*	*Organization Science*	1st round Revise and Resubmit
B	We're Hiring! Entrepreneur Characteristics and Talent Sorting in innovative Startups	Vera Rocha *Copenhagen Business School* Luca Grilli *Politecnico di Milano*	*Journal of Business Venturing*	Working paper
C	Entrepreneurship Policy and The Financing Of Young Innovative Companies: Evidence From the Italian Startup Act	Giancarlo Giudici *Politecnico di Milano* Luca Grilli *Politecnico di Milano*	*Research Policy*	2nd round Revise and Resubmit

2. Research gaps and research questions

2.1. Institutional change, human capital characteristics and startup performance

As aforementioned, entrepreneurship literature has deeply analysed the determinants of entrepreneurial opportunity discovery, business opportunity exploitation through entrepreneurial actions, and performance of the entrepreneurial activity in relation with the founders' human capital characteristics (Ardichvili et al., 2003; Choi and Shepherd, 2004; Colombo and Grilli, 2005). There is a large amount of empirical evidence on if and how previous experience (e.g. Ardichvili et al., 2003; Shane, 2000), demographic (ethnicity, gender, income level and so on) and personal (ambition, risk propensity, motivation and so forth) characteristics of founders can influence the entrepreneurial activity (e.g. DeTienne and Chandler, 2007; Douglas and Shepherd, 2002). In the same vein, the existing literature displays how the entrepreneurship positive impact for both economic and social development depends on the inflow of founders endowed with higher human capital (Beckman et al., 2007; Colombo and Grilli, 2005; 2010). However, studies in entrepreneurship have only marginally analysed the impact of institutional setting on the inclination of individuals to choose the entrepreneurial carrier.

While empirical evidence shows that institutions may strongly influence the individuals' career decisions, the literature drawn upon institutions theory is largely focused on the analysis of social and economic activities (e.g. Acemoglu et al., 2002; DiMaggio and Powell, 1983). From Scott's seminal work (1995) which describes institutions as "regulatory, cognitive and normative frameworks within which economic actors operate" many studies were conducted but institutional dimensions were mainly used to define formal and informal sets of norms that organizations and firms are expected to follow (North, 1990). In particular, empirical studies have demonstrated the impact of institutional environment, at the industry level, on firms' competitiveness (e.g. Berrone et al., 2013; Chung and Beamish, 2005) and on the exploitation of radical innovations (Bertrand et al., 2007). In this vein, more recent literature has focused on how specific

policy interventions which change the institutional context may be a significant factor in shaping entrepreneurship entry barriers and consequently important drivers in the new firm creation dynamics (Djankov et al., 2002; Sine and David, 2010). Nonetheless, studies in this stream have typically no look beyond the industry and the organizational level, or rather beyond the total rate of new ventures formation.

Despite using similar concepts and studying similar phenomena, institutional theory and entrepreneurship literature have sparsely been directly related. The rare exceptions have focused mostly on how institutions impact the rate of venture's creation, and not the characteristics and quality of individuals who found them (e.g. Kwon and Arenius, 2010; Lim et al., 2010; Stephan et al., 2015).

Notably, the studies of the impact of institutional change (i.e. policy intervention) on entrepreneurs seem to be particularly relevant in entrepreneurship literature (Hoskisson et al., 2000, Tolbert et al., 2011), only a few recent empirical studies have begun to address the research gap identified above (see for example Eberhart et al., 2017; Eesley, 2016). These studies, however, besides being few in number, were focused only on how different policy interventions, which have reduced specific types of barriers, have influenced the heterogeneity and the quality of founders and the subsequent performance of created firms. For example, Eberhart et al. (2017) has analysed the impact of a reduction of companies' exit barriers in Japan on the individuals' entry behaviour, while Eesley (2016) has investigated the effects of two different Chinese Policy interventions, that reduced several barriers to growth, on the propensity of highly skilled individuals to start their entrepreneurial carrier and the performance of their ventures. However, since these studies represent a step forwards a better understanding of institutional changes in entrepreneurship setting, they left space for further analyses. First, in both of them there is an evaluation of a reduction of one type of barrier (respectively, exit and growth barriers) in two different countries. Second, the two studies have analysed few human capital characteristics without a proper investigation of founders' human capital characteristics that may be stimulated by the policy intervention. As

highlighted in the entrepreneurship literature, the measures of human capital characteristics are many, and they have demonstrated that different characteristics have distinctive impacts on entrepreneurial behaviour (Colombo and Grilli, 2005; 2010). In addition, the focus of these two recent papers is an interesting yet rather specific institutional setting in East Asia -Japan and China -, which turn out to be different from other contexts.

Thus, starting from the research gap(s) highlighted above, I investigate whether reducing different types of barriers to entrepreneurship facilitates a more attractive entrepreneurial environment and hence increases the presence of founders endowed with better human capital characteristics who do have lucrative alternatives from entrepreneurship. Following the approach proposed by Eesley (2016), a rational individual takes the decision of exploiting a potential business opportunity by creating a new venture if the difference between the estimated benefits and costs of entrepreneurial activity exceed the net benefit of alternatives, i.e. employment (Shane, 2009). Consequently, we can define a conceptual framework synthesized by the following equation:

$$wage_{employment} < \frac{1}{Cost_{growth}} \cdot Potential\ Value_{startup} - cost_{entry}$$

Deciding to undertake the career of an employee, an individual doesn't have to sustain entry cost for setting up a new venture, e.g. bureaucratic and financial investments, and he can get an immediate salary. Accordingly, the net present value of this choice equals the predicted wage. Conversely, entering the entrepreneurial path means for an individual to bear the cost of overcoming the entry, while the potential value of the business idea (potential value) has to be additionally scaled down by the cost of overcoming the growth barriers.

Following pure economic reasoning, if an individual wants to maximize his/her return, the choice to found a startup should account for opportunity cost that equals the net present value of the salaries as an

employee (Carree et al., 2002). Consequently, the total return of becoming an entrepreneur is equal to the potential value of the startup scaled for the entry and growth costs, as well as the opportunity costs of being an employee.

Even though it is quite obvious that a reduction of both entry and growth barriers stimulates the overall born of new ventures, I argue that the two sets of policy mechanism have a different impact on individuals endowed with different human capital characteristics. Lowering only the cost of entry may impacts strongly on the entry decision of low-qualified individuals. As a matter of fact, low qualified (prospective) entrepreneurs have lower opportunity costs ($wage_{employment}$ is lower compared to high-skilled individuals) and relatively low ambitions. On the contrary, the decrease of this one-time cost might not provide sufficiently high incentives for individuals with high-human capital, who need to be convinced that the institutional conditions are favourable to scale their entrepreneurial idea. Namely, as the potential of entrepreneurs with high-human capital to grow their venture is higher (see e.g. Colombo and Grilli, 2005), so is the potential value of their startup ($Potential\ Value_{startup}$). In turn, as this value of the startup is scaled down by the growth costs, structurally lowering this typology of costs can benefit more, in relative terms, the individuals that have higher growth potential in the first place.

Along with these reasonings, I posed the following general research hypothesis: H1. The introduced institutional reform (The Startup Act) increases the propensity of individuals endowed with high human capital to establish a new venture; H2. The growth rather than the entry barrier removal engendered by the institutional reform (The Startup Act) increases the propensity of individuals endowed with high human capital to establish a firm; H3. The introduced institutional reform (The Startup Act), mainly through the removal of growth barriers, increases the propensity of individuals endowed with high specific human capital to establish a new venture.

In the second part of the study, I additionally test if the performances of new ventures founded by entrepreneurs endowed with higher specific human capital are enhanced by the institutional changes too. In fact, if the reform were only helpful to draw more high specific human capital individuals into entrepreneurship, then one would expect that the ventures of highly qualified entrepreneurs would perform similarly before and after the reform. Coherently with the aforementioned arguments, I address the following research hypothesis:

H4. High specific human capital entrepreneurs who founded their firm after the reform are the most capable of benefiting from the institutional reform (The Startup Act), mainly through the removal of growth barriers.

2.2. Access to external human resources: entrepreneurs' human capital and the presence of non-founding employees

As highlighted above, while a large body of the entrepreneurship studies have examined the human capital characteristics of founders, it is somewhat curious that few have analysed the characteristics of those individuals who join founders in their entrepreneurial activities (Coad et al., 2017; Sauermann, 2017; Siepel at al., 2017). It is largely recognized that innovative and young ventures can hardly obtain success without access to external human capital resources, like for example employees (Coad et al., 2017). The empirical research conducted, for example, by Shane (2003) and Cardon and Stevens (2004) demonstrate that hiring decision in the early stage improves a broad number of success indicators such as survival rate, growth, and profitability. Aside from the evidences given above for the fact that external resources are important for the startups' survival and growth, employees are deemed to be one of the current leading source of competitive advantage and a key actors in the entrepreneurial activities (e.g., Agarwal et al.,

2016; Koch et al., 2013; Rocha et al., 2018). Thus, startups' early stage employees (also called "joiners[1]") has started to receive a great deal of interest from the most recent entrepreneurship scholars.

Despite their acknowledged importance, new ventures encounter important limitations in attracting external human capital resources, pose both by their liability of newness (Freeman et al., 1983; Stinchcombe, 1965) and smallness (Aldrich and Auster, 1986). Startups operate generally under a high level of uncertainty and limited market distinctiveness (Moser et al., 2017). Besides, innovative startups are on average exposed to a greater failure rate than established firms (Rao et al., 2008).

Thus, given that recent literature has put a spotlight on the importance of startups employees in the business process, and given the limitations of the startups in attracting potential employee' candidates, it becomes crucial to understand how innovative new ventures can overcome the problem. In this perspective, few studies have analysed the relationship between characteristics, previous experience, and motivations of the founding team and the hiring decision process. Few research endeavours have been made in this direction recently (Bublitz et al., 2017; Coad et al., 2017; and Honorè and Ganco, 2016) but while these studies are an interesting step forward, a systematic empirical analysis of the role of founders' characteristics in the attraction of non-founder employees is still missing in entrepreneurship research. This gap in the literature is even more surprising given the depth of studies on the correlation between the entrepreneurial team formations and the human capital characteristics of the founders (e.g., Clarysse and Moray, 2004; Forbes et al., 2006; Ruef et al., 2003). As previously elaborated, paper B of this thesis is focused on the following main research question: RQ 1. Are the founders' characteristics - in terms of previous experience, human capital endowments and motivation of founding - related to the presence of non-founding employees?

[1] The term "joiners" identifies a distinctive group of employees who decide to join the startup instead of large incumbents (e.g., Honorè and Ganco, 2016), with a peculiar set of characteristics and a distinct set of preferences (Roach and Sauermann, 2015).

Moreover, an additional layer of complexity was added to the analysis with the investigation of the potential moderation effect of the startups' innovation activities. Once established whether and how founders' characteristics determine the presence of non-founding employee, I move the attention towards the presence of a sort of sorting between the entrepreneurial teams and the employees, in terms of human capital characteristics. The hypothesis is that the startups' ability to hire high-skilled employees is, like for other resource acquisition strategies (Shane, 2003), strongly related to the human capital characteristics of the entrepreneurial team (Aldrich and Ruef, 2006; Coad et al., 2017). Coherently, I address the following research question: RQ 2. Is there any assortative matching between founders' characteristics and non-founding employees' skills?

2.3. Access to external financial resources and institutional change

As aforementioned, innovative startups are also reputed to suffer from limitations in the access to financial resources. In their seminal study, Storey and Tether (1998) acknowledged "the near universal recognition of the presence of market failure in the provision of finance for new technology-based firms". Subsequently, a great number of studies have been addressed the issue of financing constraints that hinder the innovative new ventures (Revest and Sapio, 2012 for a recent literature review).

In the same vein, the entrepreneurship literature has investigated these specific limitations for young innovative companies, not only compared to established companies, but also against low-tech young ventures. The success of innovative ventures depends heavily on high-risk investments such as R&D activities, marketing expenditure to promote new products on the market, and hiring highly qualified staff (Beck and Demirguc-Kunt, 2006). Unlike large and established companies, young innovative firms have limited access to the capital market and suffer credit rationing imposed by banks mainly because of their high failure risk (Coad and Rao, 2008), limited availability of tangible assets that may be used as collateral for lending (O'Sullivan, 2005) and the use of money to finance typically high-risk projects. This problem is

particularly noticeable in the European area, which is characterized by bank-based economies and a poorly developed Venture Capital market (Revest and Sapio, 2012).

Thus, the presence of market failures in the provision of external finance for high-tech startups (Hall, 2005; Storey and Tether, 1998) clearly requires policy intervention in order to alleviate the issue (Schneider and Veugelers, 2010). Admittedly, the existing literature does not provide clear guidelines on identifying the most effective measures to put in place (Colombo et al., 2012) to each specific institutional context. For a long time, policy makers have opted for different instruments on the basis that policy strategies should be tailored to specific institutional and regional contexts to be truly effective (Wagner and Sternberg, 2004). However, even if policy interventions vary from one institutional context to another, the largest part of the existing literature is focused on the channels through the supports are provided, or in alternative if the best way to administer incentives is erga-omnes for all the companies or rather selective, or even if the intervention contemplates selective mechanisms based on type of expenditures. The largest part of the scientific debate is rounding around the question of whether public subsidies have a crowding-out or crowding-in effect on the access to private equity investments or bank loans (Czarnitzki and Fier, 2002; Hottenrott et al., 2018; Zúñiga-Vicente et al., 2014) or alternatively, if the governments should adopt a 'hands-on' approach and constitute large governmental venture capital funds or, more generally, whether (direct or indirect) intervention is really able to trigger the development of a vibrant venture capital industry (Brander et al., 2012; Grilli and Murtinu, 2014; Cumming et al., 2017). In addition, the effects of the policy law are typically studied in isolation with respect to other possible alternative policy measures firms may have access to (see for example Colombo et al., 2011; Grilli et al., 2018). However, there is no empirical evidence whether different type of startups decide themselves to use specific policy instruments rather than another, or if they are forced to use that one. Even more importantly, eventual mutual interrelationships arising between different policy measures directed at YICs have largely remained unexplored. In particular, even though industrial policy coordination phenomena was largely

theorized (Cooper and John, 1988; Durlauf, 1993) and investigated in several empirical studies (Rodrik, 1996), the existence of some sort of entrepreneurship policy coordination for access to external financial resources for YICs has never been investigated before.

Thus, the third paper of this thesis analyses the effect of policy intervention in the reduction of financial limitation for young innovative companies. In particular, taking advantage of the law 221/2012, which includes at the same time two different measures for the support of the two main sources of external financial resources: (i) a fiscal incentive program for VC investments and (ii) a Government-guaranteed (GG) bank loan program. In the same context investigated in the previous two studies, this paper investigates the possible presence of mutual interdependencies between the two different sources of financing, and the underlying policy mechanisms. Specifically, the essay C answers the following questions: RQ 1. Do Government-guaranteed bank loans and fiscal incentives for VC equity investments flow towards YICs with the same characteristics or, conversely, the two typologies of subsidized investors target rather different YICs?; RQ 2. Does access to one type of subsidized financing measure facilitate or, conversely, depress access to the other source?

By combining the answers to the two research questions, it is possible to ascertain four different scenarios to describe the effect of policy intervention on the financing of YICs; These scenarios are synthesized in Table 2.

Table 2. Taxonomy of the different scenarios about the policy effect on YICs of tax benefits on equity investment and government guarantee on bank loans

Interrelationships between policy intervention **Type of YICs**	*Substitutability*	*Complementarity*
Same	Shadow effect	Matthew effect
Diverse	Task segmentation effect	Halo effect

The upper-left cell labelled *Shadow effect*, where GG bank loans and subsidized VC investments are directed to the same typology of innovative startups, and the access to one of the two investors has a sort of exclusion effect on the other, given that the probability to access the other is significantly reduced. In this scenario, the investment conducts of VCs appear to converge substantially from banks, indicating that the two policy mechanisms might increase the *cannibalization* risk between the two types of investors. The cell in the lower left corner is called *Task segmentation effect*. In this case, different types of startups are served by different investors, but again the access to one type of measure decreases the probability for a YIC to access the other one. In this case, a sort of "institutional division of labour" is in place between the two measures, with each instrument directed to a specific type of YICs. On the right side, the *Matthew effect* scenario identifies the situation when banks and VCs target the same type of YICs, and after the access to one type of measure, a YIC has more opportunities to access other financing sources (Merton, 1968; 1988). This is the scenario where the presence of synergies between the two policy mechanisms reveals the relevance of a "stamp of approval" phenomena (Lerner, 2002) among the different (subsidized) types of investors. Finally, the lower-right cell is labelled as *Halo effect* (Lerner, 2002) where banks or venture capitalists target different types of YICs, but the access to one type of external financial resource enhances the opportunity to access funds from the another.

3. Analysis context and data collection

This thesis stems from the Horizon 2020 project called "Financial and Institutional Reforms to build Entrepreneurial Society (FIRES) in Europe". The project which included scholars from several European universities set out to reignite the European entrepreneurial structure and formulate entrepreneurial reform strategies.

The targeted companies are defined as "startups innovative" (Innovative startups). To be qualified as an innovative startup, the firm must have existed for five years old or fewer, cannot distribute dividends (or have not distributed dividends in the past), and cannot be publicly listed on a stock-market. Furthermore, the total annual revenues must be less than 5 million euros, and the firm cannot be born from merge or acquisition of existing companies. An element of great interest, and arguably what makes this context truly unique, is the introduction of the innovation's criteria. Innovative startups must possess at least one of the following three features: (*i*) the startup (or its founders) should possess tangible intellectual property rights, such as a patent or a license; (*ii*) startups' investments in R&D should account for at least 15 percent of the revenues (or operating costs if they exceed the revenues); or (*iii*) at least one third of the employees (including founders) must hold a PhD or a research tenure or at least two thirds must have obtained a Master degree. The purpose of these requirements is to include all the startups' companies which base their businesses on knowledge and innovation, as well as to attract highly-qualified human resources into the high-tech entrepreneurial activity.

In order to carry out the analysis reported in paper C, a new hand-collected longitudinal database was created, gathering complete company information of the whole population of Italian YICs at December 8th 2014, which amounted to 3,006 firms. In particular, the dataset is composed of 2,526 Italian startups. The data was collected from three sources. First, AIDA, i.e. the Italian fine-grained version of the Amadeus-Bureau Van Dijk database was used to collect accounting and demographic information. Second, the

Italian Chamber of Commerce's database was used to collect information about shareholder composition, firm financial structure and the evolution of each over time. Third, data on the access by YICs to the GG bank loans program was provided by the Italian Ministry of Economic Development.

Instead, for paper A and B, the datasets were created starting from the survey launched by the National Committee of the Italian Ministry for Economic Development on the "Monitoring and Evaluation of National policies for the Eco-system of Italian Innovative Start-ups" and administered by the Italian National Institute of Statistics (ISTAT) in April and May 2016. The aims were twofold: first, to investigate the entrepreneurs' assessment of the public policy measures that were put in place in this domain. Second, to collect information on Italian innovative startups along with a series of dimensions including the human capital endowment of the founding teams, their innovation strategies, firm growth performances. All the innovative startups listed in the special registry of young innovative startups as of December 31st 2015 (5,150 firms) were mailed in March 2016 with the goal of creating the first national statistical survey of innovative startups. The survey was administered from April 2017 to May 27th 2017. Out of the total population of the startups that the questionnaire was sent to, 2,275 completed it (at least, partially). This represents a response rate of over 44% and which is very significant percentage for a voluntary statistical survey.

Starting from the survey, two datasets were created to answer the research questions listed in the previous Sections. In particular, for essay A, complete information for the founders' human capital characteristics was collected for 1,769 YICs (35% of the total population). Then, for the purpose of the research, additional data about accounting and demographic information was retrieved from the AIDA and from ISTAT databases. For essay B, I looked at matched employer-employee data collected through the survey, using the startup as the unit of analysis. Practically, employees' human capital characteristics at the individual level were left, while the entrepreneurial team information was aggregated at the company level. I was able to collect information for 1,696 startups and a total of 3,294 observations.

4. Overview of the Dissertation and main results

Table 1 shows each paper's overview. In each, I focus on one specific aspect of the entrepreneurial activity. In particular, paper A analyses whether an institutional change – the Italian policy intervention 221/2012 – creates a favourable environment that can increase not only the number of new ventures, but more importantly its quality. In particular, the study disentangles how the reduction of entry and growth barriers to entrepreneurship impact different types of individuals to enter. Furthermore, the paper investigates if (and how) the combination of the human capital of the founding team and the entry/growth incentives introduced by the law, influence entrepreneurial performance. The study exploits a unique dataset of 1,769 innovative Italian startups to identify the effect of the institutional change on founders' characteristics and performance. Based on a set of hypotheses on the impact of institutional change on founders' human capital, the results show that policy interventions designed to reduce barriers to entrepreneurship increase the propensity of individuals with high human capital to become entrepreneurs. Furthermore, the empirics indicate confirmation of hypothesis 2: individuals endowed with a high level of human capital are found to be more prone to become entrepreneurs after the growth reform was introduced. Interestingly, the results show that the growth reform only impacted founders with high specific human capital, while no significant influence is found for the ones with high generic human capital. Finally, the results support the hypothesis that removing growth barriers through an institutional reform increases the difference in terms of growth between innovative ventures founded by individuals endowed with high specific human capital and those with low specific human capital. Particularly, firms founded by individuals endowed with high levels of specific human capital performed better after the policy intervention. This study departs from the extant research in several aspects. First, it examines in a unique institutional context while also examining how the reduction of entry and growth barriers impacts the dynamics of entrepreneurship. Second, the study distinguishes between specific and generic components of human capital, digging into the nature and type of human capital that is most

influenced by institutional change. Third, the study not only analyses how the reduction of different barriers impacts different types of human capital endowment of entrepreneurs, but also investigates the overall performance and interaction of startups.

Paper B investigates the relationship between founders' characteristics and the likelihood of attracting non-founding employees. It draws mainly on resource-based theory, examining first the relationship between both founders' human capital – in particular their previous entrepreneurial experience – and motivations and the presence of non-founding employees in the venture. Second, it adds a new layer of complexity to the analysis by investigating whether and how the innovation intensity of the startup affects these relationships. Finally, it builds on the recent discussion on human capital sorting in startup settings (see for instance Honorè and Ganco, 2016; Rocha et al., 2018) by studying the relationship between both founders' characteristics and the average quality of non-founding employees in the venture, while accounting for possible self-selection bias in the decision to hire human resources beyond the founding members. The research hypotheses are tested on a dataset of 1,696 Italian startups, built from a survey administered in 2016. In a nutshell, the results show that entrepreneurial teams endowed with greater prior entrepreneurial experience – are more likely to hire in early stages, especially in more dynamic contexts characterized by higher investments in R&D. The empirics fail to find similar support for two other dimensions of entrepreneurs' human capital though (managerial experience and education level). Furthermore, the analysis is complemented by also considering the role of entrepreneurs' motivations to found, and the results show that necessity triggers can propagate entrepreneurs' disadvantages relative to their opportunity-driven counterparts by damaging their ability to attract talent. Moreover, the analysis confirms the existence of a positive sorting between entrepreneurs and employees: better educated entrepreneurs are more likely to be matched with better educated employees (and with employees whose skills fit the job they are assigned to), and more experienced entrepreneurs are more likely to be matched with more experienced employees, as theorized in the paper. Furthermore, the results suggest

that it might be preferable to have somehow diverse entrepreneurial team members with different – and complementary – human capital characteristics, not just for their potential contribution to the success of the startup (Smith et al., 2005), but also because these teams seem to have a higher likelihood of attracting employees with different and complementary skills (i.e., high education and experience). This diversity in between founders and employees is to be central to the positive performance of startups (De Winne and Sels, 2010). Teams who found their ventures out of necessity appear to be disadvantaged, often matching with employees of relatively lower human capital.

Paper C focuses on the effectiveness of different policy instruments which at the same time and in the same institutional context on the reduction of young innovative companies' (YICs) financial constraints. Again, by taking advantage of the Italian Startup Act and exploiting a quasi-natural experiment, in this paper I investigate the possible interrelationships between the access to a Government-guaranteed (GG) bank loan program and the fiscal incentives for venture capital (VC) equity investments. The results indicate two relevant facts. Firstly, they indicate the presence of relevant differences among YICs in terms of access to the two different financial resources and the underlying policy interventions. More specifically, GG bank loans show a relatively higher propensity than VC investments to flow towards very early stage companies. Equally, small-sized YICs seem to have significant advantage accessing GG bank loans more than so VC investments (notwithstanding the fiscal incentives). On the other hand, results related to the Substitutability vs Complementarity analysis point to the presence of a substitution effect. Once backed by a VC, a YIC is less likely than before to access a GG bank loan. This result highlights how the investment in equity made by a VC reduces the likelihood by the new venture to get a GG bank loan. In conclusion, these results point to a sort of "institutional division of labour" between the two policy measures under investigation, and the presence of a Task segmentation effect. Practically speaking, the two different policy mechanisms serve the needs of different new ventures. Moreover, the access to a type of financing reduces the chance to obtain the other form. In order to gauge the strength of our

finding, I ran several robustness checks, each of which adopted specifications and alternative methodologies. These checks are addressed in essay C. Overall, the findings reveal the presence of an interesting nuance across different startups' industrial sectors or geographic locations. However, what matters most to us is that these findings confirm the main results and bring support to the Task segmentation effect.

5. Main contributions and impacts

The goal of this doctoral thesis is to deeply analyse of three main determinants of entrepreneurial growth - human capital, external human resources, and financial resources – in a unique institutional setting and through the lens of comprehensive policy intervention.

Going deeper into the analysis of the academic contributions, the results of the paper A clearly show the positive effect of the barriers reduction on the propensity of individuals endowed with high-human capital to start the entrepreneurial career. More specifically, the reduction of startups' growth barriers impacts more significantly high skilled individuals to start their business, as well as a super-additive effect of better specific human capital endowed on growth. These findings contribute to reducing many literature's gaps. First, few recent studies have analysed the intersection between institutional change theory and entrepreneurship. Actually, existing researches have mainly studied the role of entry barriers as a pivotal mechanism influencing founding decisions (Dobbin and Dowd, 1997; Klapper et al., 2006; Meek et al., 2010), while just very recent studies have tested reduction of growth and exit barriers (Eesley, 2016; Eberhart et al., 2017). However, no one as analysed two types of mechanisms at the same time and within the same institutional context. Moreover, paper A sheds light on how a comprehensive policy intervention, which encompasses several mechanisms to reduce both growth and exit barriers, impacts individuals' entrepreneurship attitude. In particular, the effects of the policy intervention are measured at individual-level, as rarely did by previous studies. Since the existing literature disentangles the effects of institutional change at the organization or industry levels, this study observes how the reform affects individuals endowed by different kinds of human capital. As widely described in the previous Sections, the analysis result confirms that the reduction of barriers to growth attracts to entrepreneurship individuals endowed with high specific human capital, who are considered the most likely to succeed in knowledge-intensive sectors. Moreover, this study poses its attention on direct (and indirect) impacts of policy

interventions for what concern startups' performance, in terms of growth and innovative activities. The empirical results have confirmed the relevance of the institutional change also in this perspective, highlighting the existence of a super-additive effect between the policy instruments and founders' specific human capital on the growth rate of the startups incorporated after the law. This study contributes to enlarge the knowledge on the effects of institutional changes not only on the new firm creations but also on the startups' growth process. In fact, the existing institutional researches in the entrepreneurial field are usually deal only taking into account the effect of decreasing of barriers to entry on startups' born rate and survival (Djankov et al., 2002). Instead, this paper shows how a reduction of barriers to growth improves new ventures' performance, also thanks to the attraction of individuals endowed with high human capital and, in particular, on entrepreneurs with specific work experience.

Second, this essay contributes to the existing literature connecting the studies which have inspected individual characteristics that lead the individuals to entrepreneurial career (Shane, 2000) and the resource-based view studies that have analysed the determinants of entrepreneurial ventures' success, such as founders human capital characteristics (Åstebro and Thompson, 2011; Colombo and Grilli, 2005; 2010). The results show that the policy intervention engages an increased number of high-skilled individuals into the entrepreneurial career path and, more interestingly, these entrepreneurs are the ones who benefit the most from the structural reduction of the barriers in growing their businesses. Consequently, this essay demonstrates that the reduction of growth barriers through a specific policy intervention can create an appealing environment for the right individuals (Ahuja and Yayavaram, 2011; Khanna and Palepu, 2005), who have more chances to succeed.

These empirical findings offer relevant implications for policy makers and governments. The results highlight that the quality of entrepreneurs could be affected by policy interventions even in the short term. In particular, governments should focus on the reduction of the barrier to growth to attract prospective entrepreneurs, especially the ones with high human capital endowments which typically have

better chances to succeed. Thus, considering the fewer resources available to support the entrepreneurial activities, governments and policy makers should give priority to growth-related benefits such as more flexible labour regulations, tax credits for hiring process and incentives for investors.

Afterwards, paper B analyses the role of entrepreneurial experience and human capital characteristics of the founding team from a different point of view. In particular, the relationship between entrepreneurs' characteristics and the decision to hire. Studying the startups' hiring decision, this essay highlights the positive relationship between human capital characteristics of entrepreneurs and the likely to hire in the early stage. Adding to this, it emerges that entrepreneurial experience is a particularly relevant factor to attract non-founding employees, especially in innovative environments characterized by higher R&D expenditure at the company-level. Moreover, the results support the existence of an assortative mechanism between entrepreneurs and joiners, in the form of either more educated or more experienced employees. Starting from those highlighted above, the main novelty of this paper resides in a clear distinction of the resourced based-perspective in the entrepreneurial frame. Building on the extensive literature emphasizing the role of human capital characteristics of founders for startups' success (e.g., Cassar, 2014; Colombo and Grilli, 2005; Cooper et al., 1994) this study sheds light on a specific channel through which entrepreneurs can achieve high performance and fast growth: by attracting and retaining the best-talented joiners in a timely manner. Moreover, even though widespread literature refers to the need of securing human resources especially in innovative contexts (Klaas et al., 2010), entrepreneurship scholarship has been relatively more silent about *how* these resources can be acquired and what is the role of entrepreneurs' heterogeneity in skills and experience in this process. The paper analyses also the relationship between entrepreneurs' motivations to found and the startups' hiring process, and the results show that necessity-driven founder may spread entrepreneurs' disadvantages compare to their opportunity-driven counterparts, mainly due to their inability to set up fast growing business (Block et al., 2015). This study has several implications for the theoretical understanding of the entrepreneurial

recruiting process. In particular, hiring is a two-sided matching process driven by demand- and supply-side forces that need to be aligned in order to make talent acquisition a successful endeavour for startups. This study highlights that a great deal of this success is related to the entrepreneur's - or the entrepreneurial team's characteristics, mainly because these characteristics provide reliable signals to candidates about the startup's potential and quality. The study addresses also the moderating role of R&D intensity in the hiring process. The intersection between entrepreneurship and resource-based theories should be ready to embrace contextual differences (at the firm- or other levels) more often, in order to enrich our understanding of the boundary conditions possibly limiting or amplifying the role of individual entrepreneurs in startup's hiring strategies.

This study has also important policy implications. This paper represents a counterpoint to the resource-based view perspective in entrepreneurship by arguing for the importance of startups' human capital not just affecting startups performance per se (Ardichvili et at., 2003), but also in the creation of occupation and social benefits. Moreover, this study's findings are of great interest also in the literature related to the entrepreneurial team's formation. The existing literature emphasizes the role of complementarity skills as preconditions for startups success. Finally, the results of the study have interesting implications for the entrepreneurial team's formation. Since high educated entrepreneurial teams tend to attract high-educated employees, while founders endowed with better entrepreneurial experience are more likely to hire the high-experienced non-founding' employee, the combination of entrepreneurs might reduce the issues in the hiring process.

Paper C analyses the effect of the same policy intervention on the access to external financial resources for young innovative companies. The topic is extremely relevant because YICs are deemed to suffer from important capital market imperfections (see for example Carpenter and Petersen, 2002) which may prevent their access to external equity investments and loans rationing. Consequently, these financial limitations may avoid YICs from exerting their beneficial effects in terms of innovation and economic

growth. Thus, while scholars and policy makers agree on the need for policy intervention to alleviating these financial constraints, there are no shreds of evidence on the most effective intervention to put in place. In this respect, few studies have analysed the effectiveness and potential interrelations of different policy instruments which, at the same time and in the same institutional context, are offered to YICs to reduce their financial constraints. Starting from the Italian Startup Act (Law no. 221/2012), the essay sheds light on this key issue. The peculiarity of the intervention lies in the fact that innovative startups are disclosed at the same time to two specific mechanisms specially designed to reduce the financial limitations, i.e. fiscal reductions for venture capital investments and a Government-guaranteed (GG) bank loan program. Starting from the research questions aforementioned, the empirics show that the two interventions are functional to different typologies of startups. In particular, younger and smaller startups seem to be more prone to get GG bank loans than those YICs backed by (subsidized) VC. In other words, it is observable a sort of 'institutional division of labour' between the two measures, with each instrument financing a given typology of YIC. As expected, in their investment conducts VCs appear to diverge substantially from banks, and the policy intervention does not change radically the selection process. On the other side, the introduction of the GG fund entails a significant reduction for bankers of the negative effects deriving from information asymmetry.

On the other side, the results speak in favour of a substitutability effect between the two instruments, since the access to one type of investment reduces the likelihood to obtain the other. Overall, our findings support a Task Segmentation effect between the two policy mechanisms.

The findings have important implications for policy makers. First of all, they highlight how an entrepreneurship policy intervention which encompasses different instruments for the subsidization of both debt and equity investments does not present serious cannibalization risks and crowding-out effects. The two type of investors, and the two underlying policy mechanisms, simply flow towards different types of firms.

Second, the privileged access for YICs to a Government-guaranteed (GG) bank loan program introduced by the law entails a significant reduction of the effects of type 1 risk for the bankers (see for example Jensen and Meckling, 1976), encouraging banks to lend also to young and small YICs. This evidence is particularly relevant in a bank-based system like Italy - as well as for the rest of the continental Europe - where YICs have to rely on bank debt as the primary source of external financing (Colombo and Grilli, 2007). Additionally, the fiscal reduction envisaged for VC investments do not seem to have produced shifts on the characteristics of VC targets, but, at the same time, surely contributed to increasing the number of VC investments in the thin Italian VC market (Bertoni et al., 2018).

Lastly, the results confirm the previous evidence on how it is difficult to stimulate different typology of private investments at the same time (Rodrik, 1996). This may depend on the investment's demand saturation, which is not necessarily a negative result from a social welfare point of view. However, it is quite clear that the absence of any kind of synergies between the two policy mechanisms seems to reveal the irrelevance of "stamp of approval" phenomena (Lerner, 2002, p. F78) running among the different (subsidized) financial operators.

6. Limitations and future research developments

Despite the relevant results, the three papers have faced some unavoidable limitations that will require further research endeavours. First, I acknowledge that a question of generalizability of the findings arises, since the context of analysis. In particular, as highlighted by several studies, Italy experiences a technology gap and represents a slow innovative environment compared to the leading countries (see e.g. Nuvolari and Vasta, 2015). Moreover, Italy may suffer from a more severe lack of key resources necessary for innovative activities which could widen the gap further with countries like the US. In this respect, replication studies in other contexts would admittedly contribute to strengthening what has been theorized and empirically analysed with respect to innovative startups.

However, starting from the results reported in the first essay, it is worthwhile to note that the reduction of growing barriers - introduced by the law 221/2012 - have the same qualitative effect as the one observed in China in a different time frame by Eesley (2016). Thus, I expect the results obtained in paper A remain the same in general and only the magnitude may differ across different institutional contexts. Nevertheless, a main drawback of the article A resides in the inability to address the effect of the exit barriers' reduction, since I was not able to measure if the entrepreneurs took into consideration the exit instruments introduced by the policy intervention. Thus, I cannot exclude that part of the explanatory power that has been associated with entry and growth barriers reduction might be related to the exit instruments. Further investigations in this direction may be helpful in the understanding of the specific role of exit barrier reductions.

Moving on to paper B, in analysing the relationship between entrepreneurs' characteristics and the presence of non-founder employees, only individuals' human capital characteristics were considered. Nevertheless, also other factors like the offered salary and the employees' motivation may matter, influencing how the joiners perceive the workplace. Further investigations in this direction are requested

to better understand the relationship between entrepreneurs' characteristics and employees. Moreover, I was not able to collect information about firms' performance before and after the (first) hiring event. Furthermore, the dataset used in this study is a cross-section, thus it was impossible to claim any causal relationship.

Turning to the relation between policy intervention and access to external financial resources analysed in paper C, there are potential issues on the theoretical and empirical point of view. First, even if the interrelation between subsidized VC investments and access to GG bank loans may be principally imputable to the preferences of the startups (demand-side) rather than supply-side forces, it is not possible to determine it with certainty on a priori ground. Thus, further research endeavours are required. Second, I was able to observe only a relatively short time span, with a clear limitation in the evaluation of the effects of the policy. In this perspective, future researches should start from the collection of data over a longer period, in order to assess a more comprehensive evaluation of the institutional change. Finally, while the effects of the policy intervention of the access to external financial resources are observable on the short period, a specific analysis on a longer period of time is needed to measure the impact of the specific subsidized financing modes on the performance of the financed firms after the startup phase.

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Paper A. Do The Rules Of The Game Determine Who Is Playing? Institutional Change, Entrepreneurship and Human Capital

Abstract

Prior research shows that entrepreneurship enhances economic development. However, it is becoming increasingly evident that it is not the number of new startups that matter for that goal, but rather their quality. This paper contributes to the nexus of entrepreneurship and institutional theory by studying whether an institutional change can facilitate the transition from quantity toward quality of entrepreneurship. We investigate the effect of the Italian policy intervention targeting young innovative companies on the human capital of entrepreneurs, and how that influences entrepreneurial performance. We exploit a quasi-natural experiment setting by decomposing the impact of lowering entry and growth barriers for low and high human capital founders. The findings indicate that the reform, and in particular lowering growth barriers, attracts founders endowed with the most valuable industry-specific, managerial and/or entrepreneurial experience. These individuals are also found to be able to capitalize on the introduced benefits the most. Overall, we demonstrate that an institutional change that decreases barriers to entrepreneurship, and most importantly fosters access to funding and acquisition of highly skilled labour, is able to attract superior entrepreneurs.

Keywords: Entrepreneurship policy; Institutional change; Barriers to entry; Barriers to growth; Human capital.

Running title: Effects of institutional change on entrepreneurship.

Introduction

Ever since the seminal work of Meyer and Rowan (1977), researchers have used an institutional approach to study organizations (Campbell 2007, Greenwood and Suddaby 2006, Hoffman 1999, Marano and Kostova 2016). Despite evident pertinence and applicability of this view for understanding new venture creation process as well, most of the efforts were dedicated to established organizations, and the studies on how organizations are formed have been surprisingly scant. The lack of attention for the foundation process of new organizations may be a consequence of the fact that institutional theory was rooted in sociology, which predominantly focused on formal structures and regulations as the main source of organizational efficiency (Tolbert et al. 2011). These macro-level features are often absent from the early stage of organization's lifecycle.

In parallel, the entrepreneurship literature has been studying elaborately characteristics of individuals to explain the process of entrepreneurial opportunity discovery, as well as outcomes of entrepreneurial activity. In particular, that wide literature puts forward the idea, for then documenting, that prior experience and personal characteristics of individuals play a significant role in entrepreneurial dynamics, and primarily entrepreneurial entry (DeTienne and Chandler 2007, Douglas and Shepherd 2002, Foo 2011, Lévesque and Minniti 2007, Shane 2000, Waldinger et al. 1990).

In spite of akin concepts they use and phenomena they study, institutional theory and entrepreneurship literature have sparsely been directly related. The rare exceptions have focused mostly on how institutions impact the rate of new venture creation, and not the characteristics and quality of individuals who found them (e.g. Kwon and Arenius 2010, Lim et al. 2010, Peng et al. 2010, Stephan et al. 2015). While entrepreneurship is found to matter for both economic and social development (see for instance Audretsch 1995, Audretsch et al. 2006, Carree and Thurik 2003), that positive impact strongly depends on the inflow of high quality individuals into entrepreneurship (Beckman et al. 2007, Colombo and Grilli 2005, 2010, Eisenhardt and Schoonhoven 1990), and innovativeness of new ventures (Shane 2009, Wong et al.

2005). Thus, there is a salient need to understand also how institutional settings can create a favorable environment that can increase not only the level of entrepreneurship, but more importantly its quality. The significance is even more relevant as institutions can be (to some extent) adjusted through policy measures.

Few studies try to enlarge this view and examine how an institutional change can impact different types of individuals to enter the entrepreneurship arena. Unlike the preceding stream that deals with barriers to entry (Dobbin and Dowd 1997, Sine and David 2003, Sine and Lee 2009), which is inherently limited to observing founding rate as the outcome, these more recent studies emphasize the impact of lowering different barriers to entrepreneurship. Specifically, Eberhart et al. (2017) investigate whether an institutional change that eases exit barriers enhances new venture growth. They study a sample of entrepreneurial ventures before and after a bankruptcy reform in Japan, and find that lowering barriers to exit increases not only the number of entrepreneurs, but more importantly the number of more capable ones, i.e., those who are more likely to launch high growth ventures. Eesley (2016), on the other hand, observes two institutional changes in China to understand how lowering barriers to growth encourages entrepreneurship by individuals endowed with high human capital. He focuses on alumni of a top Chinese university and shows that only a significant decrease of the growth barriers convinces highly skilled individuals to found a firm.

We build on the idea that institutional changes that reduce different types of barriers to entrepreneurship impact not only the quantity of entrepreneurs, but also their entrepreneurial quality in terms of the skills and competencies of the individuals who become founders. In doing so, this paper departs from the extant studies in several respects. First, this research endeavor integrates two different mechanisms through which institutional changes can influence creation of new ventures, i.e. we examine how reduction of entry and reduction of growth barriers impact entrepreneurship dynamics. While the effects of institutional change related to the entry barriers have been widely studied to date, institutional change

that decreases barriers to growth has only recently been introduced as a theoretical mechanism (see Eesley 2016). Nevertheless, the previous study tests the two mechanisms (reduction of different barriers) separately, which does not provide conclusive evidence on the relative importance of each of them. We instead confront their impact within the same institutional reform.

Second, the paper answers the call to extend the work on the relationship between the institutional environment, entrepreneurial entry and high quality entrepreneurship (Acs et al. 2016, Shane 2009). There are two advancements in this respect.

On the one hand, we dig into the nature and type of human capital that is most stimulated by the institutional change. In particular, we follow the seminal distinction between *specific* and *generic* components of human capital (see Becker, 1975). Generic human capital embraces all the general knowledge that an individual may acquire through education and work experience that, albeit important, has no direct and exclusive application to a specific domain. While specific human capital refers to those skills and capabilities that can be immediately and directly applied (and have value only) in a specific context. In our framework, these competences (see Colombo and Grilli 2005, p. 796) point to "*industry-specific* human capital obtained by founders through prior work experience in the same industry. They also include knowledge of how to manage a new firm, that is entrepreneur-specific human capital; this is developed by founders through "leadership experience (Bruderl et al. 1992)". Since the specific component is considered the most critical in knowledge-intensive sectors for new opportunity exploitation (e.g. Shane 2000) and new venture growth (e.g. Colombo and Grilli 2005, 2010), the institutional change in this domain should especially aim at increasing the attractiveness of the entrepreneurial career to individuals endowed with high *specific* human capital.

On the other hand, we study how reduction in different barriers impacts different types of human capital endowment of entrepreneurs, overall entrepreneurial performance, as well as their interaction. That is,

we study if founders endowed with high (specific) human capital can create higher quality ventures by leveraging the positive institutional change (both in terms of reduction of entry and growth barriers), which had attracted them to become entrepreneurs in the first place.

The third set of advantages pertains to the nature of our data. We focus on an unexplored, yet extremely relevant institutional context – Italy, that likewise most European countries, suffers a gap towards the U.S. in the capacity to generate viable and successful startups in knowledge-intensive industries (Grilli and Murtinu 2014), and it is characterized by a structurally weak national innovation system (Nuvolari and Vasta 2015). In this setting, we have collected data on complete founding teams and not just the principal founder (differently from other recent studies, see e.g. Hmieleski et al. 2013, Rauch and Rijsdijk 2013) in knowledge-intensive sectors, which are found to contribute to the economic development the most (Audretsch and Fritsch 2003, Spence and Hlatshwayo 2012).

We conduct our research by relying on the *Italian Startup Act* (that is, Law no. 221/2012) that was implemented in 2012 to facilitate the creation of high quality companies in the Italian economy. The Startup Act envisaged a wide bureaucratic and administrative simplification (typical barriers to entry), as well as some benefits as tax incentives, more flexible labor regulations (typical barriers to growth), lighter rules on insolvency and "fail fast" procedure. By exploiting the retroactive nature of the mechanisms, we are able to perform a quasi-natural experiment to discern what impact this policy reform had on the quality of created firms in terms of founders' human capital and innovation strategy. Furthermore, the impact of the Startup Act is studied in relation to the performance of the start-up, including the same variables related to human capital and control variables.

The rest of the paper is organized as follows. We first provide the theoretical foundation related to institutional change, human capital and performance in entrepreneurship. After developing the

hypotheses, we briefly explain the complex institutional change we take advantage of to test them. Then we present and discuss the results, and conclude with implications for theory and public policy.

Theoretical background

Institutional theory has been a diffused research lens for analyzing social and economic activities (e.g. Acemoglu et al. 2002, DiMaggio and Powell 1983). The seminal works describe institutions as regulatory, cognitive and normative frameworks within which economic actors operate (Scott 1995). These institutional dimensions define formal and informal sets of rules that organizations are expected to follow (North 1990). As extensive research on the topic has shown, the institutional environment can impact competitiveness and firm behavior on an industry level (e.g. Berrone et al. 2013, Chung and Beamish 2005, Delmas et al. 2007). For instance, Bertrand, Schoar, and Thesmar (2007) present how the shift in regulations of the banking industry in France during the 1980s improved market competitiveness and allocative efficiency of the system by incentivizing the process of Schumpeterian "creative destruction". More specifically, a more recent stream has brought up the argument that institutional change, primarily stemming from the changes in regulations, is a significant factor in shaping entry barriers and hence new firm creation dynamics (Djankov et al. 2002, Klapper et al. 2006, Sine and David 2010). For example, Kaplan, Piedra, and Seira (2011) show that simplification of company registration procedures in Mexico, though mostly temporarily, increased the rate of new ventures by about 5 percent per month in targeted industries. In the same vein, by analyzing a natural experiment based on the unification of East and West Germany in 1990, Prantl (2012) found that stricter entry regulation depresses promising entrants and their long term performance. However, rarely have these studies looked beyond the industry and the organizational level, or rather beyond the rate of new business formation.[1]

[1] A few exception do study how institutional change impacts individuals (see for instance Colyvas 2007), yet not related to entrepreneurial activity.

Another stream of literature focused on entrepreneurship has vastly studied micro-determinants of entrepreneurial opportunity discovery, business opportunity exploitation through entrepreneurial actions, and outcomes of entrepreneurial activity related to characteristics of the individuals (Ardichvili et al. 2003, Choi and Shepherd 2004, Colombo and Grilli 2005). There is a plethora of evidence that previous experience (e.g. Ardichvili et al. 2003, Shane 2000), demographic (ethnicity, gender, income level and so on) and personal (ambition, risk propensity, motivation and so forth) traits of individuals play significant roles too (e.g. DeTienne and Chandler 2007, Douglas and Shepherd 2002, Foo 2011, Lévesque and Minniti 2007, Van Praag and Cramer 2001, Waldinger et al. 1990). Nonetheless, studies in this stream have typically not taken into account how changes in the institutional environment may impact the relationship between characteristics of individuals and their decisions to become entrepreneurs.

This disconnection between the two literature streams has left a research gap. The effects of large-scale institutional change on individual reactions have still not been addressed (Hoskisson et al. 2000, Tolbert et al. 2011). Few research endeavors have been made in this direction recently (Eberhart et al. 2017, Eesley 2016, Hiatt et al. 2009). These studies focus on how different changes and modifications in regulations impact the heterogeneity of individuals that become entrepreneurs. More particularly, they examine how decreasing different types of barriers impacts the quality of new founders and the performance of created companies. For example, Eberhart *et al.* (2017) study a sample of entrepreneurial ventures before and after a bankruptcy reform in Japan, and find that lowering barriers to exit encourages not only an increasing number of individuals to become entrepreneurs, but most importantly, it affects the number of capable ones, i.e., those who are more likely to launch high growth ventures. Eesley (2016) observes two institutional changes in China and shows that only a significant decrease in the growth barriers impacts highly skilled founders and the outcomes of their ventures.

While these two studies make a significant step forward, they also open avenues for further analyses. First, both Eberhart *et al.* (2017) and Eesley (2016) test the reduction of one type of barriers (exit and

growth, respectively) while embodied in separate institutional changes. We think that an equally interesting aspect would be to gauge the relative importance of the decrease in more than one type of barrier within the same institutional reform. Second, measures of human capital that the two studies are forced to utilize do not permit an investigation on the *type* of founders' human capital that is most stimulated by the institutional change. Eesley (2016) proxies human capital of individuals as a single index based on education level, promotion experience and student leader experience. Eberhart *et al.* (2017) use an even more straightforward binary measure. In fact, they define elite founders, i.e. highly skilled entrepreneurs, as individuals who graduated from one of the top ten Japanese universities. Since human capital is a multifaceted dimension, as its different aspects have distinctive impacts on entrepreneurial behavior (Colombo and Grilli 2005, 2010, Feeser and Willard 1990), more fine-grained operationalizations could improve our understanding about the role of institutional change on the human capital endowment of entrepreneurs. Finally, the focus of the two studies is on interesting yet rather specific institutional settings of the Far East (Japan and China). While both works offer a nice discussion about generalizability of the findings, replication and extensions of their analysis in different institutional arrangements is necessary to shed new light on these important issues.

Therefore, in this study we try to complement these works, and elucidate how institutional change may impact entry of high-quality entrepreneurs and support them in creating high-quality firms. To that end, in the following section, we develop a set of testable hypotheses based on relevant theoretical foundations.

Hypotheses development

As previously elaborated, there is a vast literature on how lowering entry barriers by shifting regulations induces higher rates of new venture creation (e.g. Demirguc-Kunt et al. 2006, Klapper et al. 2006, Sine and Lee 2009). Instead, we pose a different, evenly interesting but less investigated question. We enquire whether reducing barriers to entrepreneurship facilitates a more attractive entrepreneurial environment

and hence increases the relative presence of highly qualified founders, who do have lucrative alternatives apart from entrepreneurship. The relevance of this research question resides in the evidence that the promise of entrepreneurial activity as an engine of economic and social development (e.g. Audretsch 1995) strongly depends on the quality of involved individuals (Beckman et al. 2007, Colombo and Grilli 2005, 2010, Eisenhardt and Schoonhoven 1990).

Following an economically sound logic, an individual would decide to pursue a business opportunity by creating a new venture if the difference between benefits and costs of entrepreneurial activity overweight the net benefit of alternatives (Shane 2009). Assuming that the main alternative is employment, we can define a simple economic framework to infer when an entrepreneurial career choice will be pursued (for a similar approach see Eesley 2016). On the one hand, if an individual choses to enter (or to stay in) the labor market, s/he will bear no entry cost for setting up a new venture, i.e. initial investment ($Cost_{entry}$), and will be able to gain the wage ($Wage_{employment}$). Accordingly, the net present value of being employed equals the predicted wage. On the other hand, if an individual opts for becoming an entrepreneur, s/he will need to bear the cost of overcoming the entry barriers (e.g. bureaucratic and financial investment), while the potential value of the business idea inherited by the created venture ($Potential\ Value_{startup}$) will be scaled down by the cost of overcoming the growth barriers ($Cost_{growth}$, e.g. structural lack of complementary assets such as infrastructure, or the presence of hindering regulations that favor public, established or foreign firms, or again difficulties and imperfections experienced in accessing the labor and capital markets). Similarly to Eesley (2016), our conceptual framework can therefore be synthesized by the following equation:

$$Wage_{employment} < \frac{1}{Cost_{growth}} \cdot Potential\ Value_{startup} - Cost_{entry} \quad (1)$$

Following this line of reasoning, one can deduce that if an individual wants to maximize her/his returns, the choice of becoming an entrepreneur should account for an opportunity cost that equals her predicted

wage as an employee (Carree et al. 2002). That is, the total returns of switching to entrepreneurship is equal to the potential value of the startup reduced for the entry and growth costs, as well as an opportunity costs of being an employee.

As noted by Eesley (2016), it is worthwhile to recognize that in equation (1), there is a different dynamic and degree to which each of the arguments can be influenced. On the one hand, "for a particular individual, the potential return in the labor market (i.e., opportunity cost) does not change easily" (Eesley 2016, p. 1292). In other terms, $Wage_{employment}$ is rather stable in the short- and medium- terms for most individuals. Likewise, the potential value of the business idea on which the startup is based ($Potential\ Value_{startup}$) is by definition idiosyncratic for each startup and consequently, on average, hardly influenced by policy making, at least in the short-run. On the contrary, costs related to entry ($Cost_{entry}$) and growth ($Cost_{growth}$) of startups can be influenced and can change in a relatively short period of time. For instance, deregulating entry can make the founding process more cost efficient (see the example of Portugal where Branstetter *et al.* 2014 found a significant impact of deregulation on founding rates within next two years). More importantly, regulation too can decrease the growth barriers, and they can do so in a fairly quick manner. In fact, industrial policy can stimulate growth of new firms by putting them in an advantageous market position, by providing them financial or other incentives, or by partially deregulating their activity in the early and growth stages of their life cycle.

Institutional change, founders' human capital and entrepreneurial entry

We argue that the combination of the two mechanisms, i.e. reduction of barriers to entry and barriers to growth, will have a particularly profound impact on highly qualified (prospective) entrepreneurs, who have a high opportunity cost (relatively high wages as employees) and might otherwise not consider the entrepreneurial path. As a matter of fact, individuals characterized by low levels of human capital have lower opportunity costs in pursuing the entrepreneurial career ($Wage_{employment}$ is low). That means that the left side of equation (1) is more likely to be exceeded with an ordinary business idea

($Potential\ Value_{startup}$ does not need to be high to induce the entrepreneurial career choice) and a small-scale startup (the realized net present value of the startup, i.e. the right side of (1), does not need to be high neither). In this respect, lowering entry and growth barriers is not expected to make such a big difference. On the contrary, individuals characterized by high human capital command a high salary in the labor market (see e.g. Amit et al. 1995, Buera 2009), thus they have a higher opportunity cost in choosing the entrepreneurial path. In order to convince these individuals to become entrepreneurs, the realized gains from the startup have to be high. In other terms, in order to induce a highly-skilled individual to pursue the entrepreneurial career she should be *ex-ante* convinced that all the relevant institutional conditions are met so that the newly founded startup could realize all its high potential. Accordingly, lowering entrepreneurial barriers in this case should have a much more profound effect. Thus, we posit the following hypothesis:

> ***Hypothesis (1)****: The introduced institutional reform (The Startup Act) increases the propensity of individuals endowed with high human capital to found a new venture.*

The two sets of instruments of an institutional change, i.e. reduction of entry versus reduction of growth barriers, influence the choice of potential entrepreneurs in different ways. Referring to equation (1), lowering only the cost of entry ($Cost_{entry}$) should have a stronger impact on low-qualified individuals as it only eases the foundation and not the scale up, which might be sufficient for them, who have less lucrative alternatives and therefore face relatively lower opportunity cost to entrepreneurship. On the contrary, the decrease of this one-time cost might not provide sufficiently high incentives for individuals with high human capital, who have a high opportunity cost and relatively high ambitions. Instead, we hypothesize that what the highly skilled group of prospective entrepreneurs could benefit more from is lowering the cost of growth ($Cost_{growth}$). Namely, as the potential of entrepreneurs with high human capital to grow their ventures is higher (see e.g. Colombo and Grilli 2005, Eisenhardt and Schoonhoven 1990, Feeser and Willard 1990), so is the potential value of their startups ($Potential\ Value_{startup}$). In

turn, as this value of the startup is scaled down by the growth costs (see equation 1), structurally lowering this typology of costs can benefit more, in relative terms, the individuals that have higher growth potential in the first place. Hence, we posit that lowering barriers to growth will have a stronger effect on attracting individuals with high human capital to entrepreneurship than lowering barriers to entry:

> ***Hypothesis (2):*** *The growth rather than the entry barrier removal engendered by the institutional reform (The Startup Act) increases the propensity of individuals endowed with high human capital to found a firm.*

In the context of YICs, not all experience can be considered equal (Unger et al. 2011). In fact, the specific rather than the generic nature of human capital appears to be especially relevant in positively shaping the entrepreneurship dynamics (Colombo and Grilli 2005, 2010, Feeser and Willard 1990, Ucbasaran et al. 2008). In terms of equation (1), this means that the potential value of the business idea inherited by the created venture ($Potential\ Value_{startup}$) is more positively associated to the specific rather than the generic component.

There are two mechanisms proposed in the literature through which this dichotomy is reflected. First, if the debate on whether entrepreneurial opportunities are created or simply discovered is still open and quite lively (Alvarez et al. 2013), there is general consensus on the fact that specific industry, business and market experience can be crucial determinants of entrepreneurial opportunities exploitation. This may not only be due to "kiznerian alertness" (Kirzner 1973), i.e. it is the specific knowledge gained in a particular sector that may help individuals in identifying neglected business opportunities in the same or related areas (Dimov 2010, Klepper 2001, Marvel and Lumpkin 2007, Shane 2000, 2003, Shepherd and DeTienne 2005, Ucbasaran et al. 2008, Venkataraman 1997), but also to the competences that are required to bring to light business ideas in knowledge-intensive and high-tech sectors. Once an opportunity is identified, the inherently idiosyncratic and often non-transactional nature of that entrepreneurial idea (Schumpeter 1912) makes impervious for an individual to sell it to someone else

(Foss 2000): exploitation of that idea should necessarily be pursued by those who are the discoverers (or creators), and allegedly, they have to become entrepreneurs (Knight 1921). The untested nature of these ideas makes also hard for prospective entrepreneurs to attract and retain specialized high-skilled workers and providers of complementary assets, with the result that the capabilities of start-ups very much reflect those of their founders, especially at inception (Cooper and Bruno 1977, Grilli 2014). Consequently, and as second reason, founders with a high level of specific human capital usually also achieve better performance than other entrepreneurs (Bruderl et al. 1992, Colombo and Grilli 2005, 2010, Cooper et al. 1994, Feeser and Willard 1990). The meta-analysis conducted by Unger et al. (2011) based on 70 empirical studies over three decades confirms that the influence of entrepreneurial task-related human capital on young firm success is positive and significant, especially in high-tech sectors.

Consequently, we would expect that removing barriers (especially those that relate to growth) will be particularly important especially for those individuals who may generate start-ups characterized by a greater potential value. Therefore, we posit the following hypothesis:

> ***Hypothesis (3)****: The introduced institutional reform (The Startup Act), mainly through the removal of growth barriers, increases the propensity of individuals endowed with high specific human capital to found a new venture.*

Institutional change, founders' human capital and growth of new ventures

We additionally argue that not only will reduction in growth barriers lead to entry of more entrepreneurs with higher specific human capital, but performance of their ventures will be enhanced by the institutional change too. If a reform were only helpful to draw more high specific human capital individuals into entrepreneurship, then one would expect that the ventures of highly qualified entrepreneurs would perform similarly before and after the reform. Instead, we posit that a super additive effect could be in place. As said before, founders with high specific human capital can recognize better, higher potential

growth business opportunities in the first place. What a reform contributes is that it lowers barriers to growth that compound with the inherently risky and uncertain side of high-potential opportunities, and consequently makes the high human capital founders more prone to pursue them. In that environment, highly skilled individuals who became founders after the reform can fully follow their most creative and ambitious ideas knowing that important institutional obstacles have been removed and therefore they will not severely impede the growth of their firm. This initial ambitious thinking and great operational effort which inductive grounded theory suggests to be an essential trait for successful innovative entrepreneurship (Dyer et al. 2008) is more impervious for those entrepreneurs that started the firm before the institutional change, because at that time the institutional hurdles were still present. In other words, founders with specific high human capital who established their ventures before the institutional change could be willing, at least in part, to remodel their focus, objectives, and strategies to take into account the new institutional landscape. But, if important organizational imprinting effects are at work (Hannan et al. 1996, Hannan and Freeman 1977, Stinchcombe 1965), it may not be an easy task for them and their firms to change the course of action (Beckman and Burton 2008). High growth strategies such as technological innovation and internationalization may be particularly difficult to implement due to inertia caused by embedded routines (Collinson and Wilson 2006). This seems to be the case even when founders are aware of the need to change (Johnson 1988).

Secondly, we already said that the removal of barriers enables founders endowed with high specific human capital to be better capable to exploit higher potential growth opportunities. This may occur also by facilitating their access to external resources. Following the line of reasoning already developed by Eesley (2016), human capital of the founding team is an important signal about the goodness of the startup for external resources providers (Hallen 2008), and in particular external investors (Gimmon and Levie 2010). Previous (specific) work experience and education of founders are found to be amongst the most reliable signals (Hsu 2007), which can be crucial in establishing relationships for attracting

customers, employees and funders. In this case, the reduction of barriers to growth that facilitate smoother scale up, will increase the reliability of this signal in the eyes of external stakeholders, and in doing so, it will make easy for highly skilled entrepreneurs to access those complementary assets which are essential for firm growth (Clarysse et al. 2011, Teece 1986). These enhanced possibilities to access key inputs and providers of complementary assets, could be only in principle available to the entrepreneurs who established the YIC before the reform. In fact, these ex-ante reform entrepreneurs could already have made some choices before the advent of the institutional change that could reveal themselves as ex-post reform suboptimal. To the extent that strong organizational path dependencies exist (Schreyögg and Sydow 2011), changing these decisions after the reform could be hard. This could be due to the non-redeployable nature of the investments already made (Cabral 2000) or be more grounded on social psychology and simply be due to a managerial reluctance to abandon the initial strategies and, instead, a tendency to further commit to them (Staw 1981, 1997). Therefore, whatever the specific reason, it is more likely that YICs founded before the reform will find themselves entrapped in a suboptimal path compared to the path they would have chosen if they could have foreseen and taken advantage of the institutional change from the beginning of their operations (i.e. ex-ante reform YICs are more likely to suffer from a "second degree path dependence", using the terminology of Liebowitz and Margolis 1995).

Overall, the aforementioned arguments lead us to posit the following hypothesis:

> ***Hypothesis (4):*** *High specific human capital entrepreneurs who founded their firm after the reform are the most capable to take advantage of the introduced institutional reform (The Startup Act), mainly through the removal of growth barriers.*

Methodology

Empirical setting

The hypotheses are tested on the Italian institutional environment that encountered a regulatory change directed at entrepreneurial dynamics. In particular, the Italian Government issued a specific law in 2012

(the Law 221/2012, modified by further amendments, the so-called *Italian Startup Act*) intended to spark the national innovation ecosystem by providing an opportunity for Young Innovative Companies (YICs) to access a range of benefits. We take advantage of the retroactive nature of the mechanism introduced by the reform to perform a quasi-natural experiment and discern what impact this institutional change had on the quality of created firms.

This setting is novel and interesting for several reasons. First, the recent studies in the field have been focused on the institutional changes that happened in China and Japan at the end of the previous and the beginning of the current century (Eberhart et al. 2017, Eesley 2016). To the best of our knowledge, we are the first to offer comprehensive analysis of the effects of an institutional change oriented to innovative entrepreneurship in the Western Europe. Second, despite being a Western economy, Italy represents a laggard innovative environment when compared to the peer countries (see e.g. Malerba 1993, Nuvolari and Vasta 2015), and the innovation gap is argued to be a consequence of serious market failures that restrict provision of key resources necessary for company's innovative activities (Colombo and Delmastro 2002). A way to fix these market failures is to introduce a change in institutions that will make up for them. Thus, the institutional reform can have a considerable effect on the entrepreneurial and innovation ecosystem. Last but not the least, the focus on the recent institutional change that happened in 2012 is advantageous due to the dynamic nature of the recent technological developments, which might moderate the impact of institutional change on entrepreneurship and innovation activities.

The targeted companies of the reform are innovative startups. In order to be considered as an innovative startup, a company needs to meet an assortment of basic criteria. First, it must be five years old or younger, it cannot distribute dividends (or have not distributed dividends in the past), and it cannot be listed on a stock market. It also needs to have annual revenues not higher than 5 million euros, and it cannot be created as a divestiture of an existing company. Furthermore, a startup needs to comply with the innovation standards. The "innovative" criteria pertains in compliance with at least one of the

following three features: (*i*) the startup (or its founders) should be in possession of tangible intellectual property rights, such as a patent or a license; (*ii*) startups' investments in R&D should account for at least 15 percent of the revenues (or operating costs if they exceed the revenues); or (*iii*) at least one third of the employees (including founders) must hold a PhD or a research tenure or at least two thirds must have obtained a Master degree. The purpose of the first two requirements is to include all the startups companies which base their businesses on knowledge and innovation, while the third requirement is strictly related to the attraction of the most qualified and highly-specialized human resources into the high-tech entrepreneurial activity, in order to reduce the innovative gap in comparison with the U.S. and other innovation-advanced countries.

Several types of incentives, exemptions, as well as access to privileged services at discounted price are granted to the registered innovative startups.[2] The benefits are mainly created to remove the usual barriers to entrepreneurship, which should in turn make the entrepreneurial activity less costly and uncertain (Hiatt and Sine 2014). The reform tackles three groups of barriers related to the phases of the entrepreneurial life-cycle (entry, growth and exit) with a series of instruments. The first batch of regulations related to the decrease of entry barriers for Italian innovative startups comprises fees and running costs waivers, and simplification of procedures for company registration that can be done digitally. The second group integrates instruments that reduce the barriers that typically impede growth of new innovative ventures. It includes more flexible and beneficial labour regulations,[3] tax incentives for equity investments made by professional private investors (business angels or venture capital firms),[4]

[2] A brief synopsis of the Italian Startup Act (and a comparison with similar legislations in other EU Member States) is provided by the European Digital Forum (2016). A complete description of the eligibility criteria and all support measures are available on the governmental website (http://www.mise.gov.it).

[3] The specifically tailored labour instruments include less rigid contract requirements, possibility of equity-based compensation and dynamic performance-based salaries for employees, and tax credit for the employment of highly skilled staff.

[4] The tax incentives for equity investment include 20 percent fiscal deduction up to a maximum investment of € 1.8 million.

government-guaranteed bank loans,[5] eligibility to report losses for an extended time period and support in internationalization activities. The final group of benefits relates to entrepreneurial exit barriers, and it includes easing of liquidation procedure without suffering significant reputational and financial costs. In this paper, we focus on the first two mechanisms.[6] Summary of the implemented instruments is presented in Table 1

Finally, it is also worthwhile noting that the retroactive nature of the policy has also allowed access to these measures not only to new ventures, but also to those firms that already existed before the promulgation of the Startup Act provided that these firms fulfilled the prescribed requirements (including the requirement to be less than 6 years old).

-- Table 1 around here --

Data

This study takes advantage of a survey launched by the National Committee of the Italian Ministry for Economic Development on the "Monitoring and Evaluation of National policies for the Eco-system of Italian Innovative Start-ups" and administered by the Italian National Institute of Statistics (ISTAT) in April and May 2016.[7] The questionnaire aims at collecting information on Italian innovative startups along a series of dimensions including the human capital endowment of the founding teams, their innovation strategies, firm growth performances and, also, entrepreneurs' assessment of the public policy measures that were put in place in this domain. Specifically, as to this latter aspect, entrepreneurs were explicitly

[5] A government-guaranteed bank loan fund is provided to ensure up to 80 percent of the credit issued of the bank, up to a total amount of € 2.5 million.

[6] The analysis on the role played by reduction of exit barriers on entrepreneurship dynamics is left to future research endeavors. In this respect, we are planning to comprehensively study the effect of reduction of exit barriers not only on entry dynamics but also on actual exit routes chosen by entrepreneurs. The recent nature of the reform does not allow us to observe a sufficient number of exits to include this interesting analysis in the present work.

[7] One of the paper authors, who is an academic member of this ministerial committee, actively participated in the questionnaire design.

asked to declare whether they had already used or intend to use the specific instruments of the implemented reform.

The questionnaire targeted the population of all registered Italian YICs, which as of December 2015 was equal to 5,150 innovative startups. The questionnaire was filled with partial information from 2,275 firms, leading to a considerable 44 percent response rate, and with complete information for the variables of interest of this study for 1,769 YICs. The sample is ensured to be representative of the population on all dimensions on which ISTAT has information on both sides, i.e. population and sample, including firms' geographic location, industry affiliation, age and legal status (see Appendix A for more details). Another concern regarding the dataset is survivorship bias since the companies are not sampled at their birth, but we are able to include in the survey only the companies that had survived until the moment of the survey. We elaborately deal with the potential survivorship bias issue in Appendix A, where we both conceptually and empirically show that it should not exert a severe confounding effect on the findings of our analysis.

Estimation methods

In the estimation methods we closely follow the empirical strategy implemented by Eesley (2016) also for the purpose of increasing the comparability of results across the different institutional settings analyzed by our and his study. More specifically, we opt for the difference-in-differences (DID) estimation technique that accounts for a time trend.[8] As stated by Eesley (2016, p. 1297), "by controlling differences due to time before and after reform and differences between high and low human capital individuals, this empirical strategy helps to identify the effects of institutional change net of any differences due to education level, age, and other time trend effects". The *difference* of relevance in our analysis is the

[8] Difference-in-difference approach is able to isolate the institutional influence from the other unobserved ones. Nevertheless, it is worth noting that apart from the Startup Act, no other relevant institutional changes took place during the period of interest (e.g. there were no governmental efforts to increase education levels). Hence, the concerns of unobserved contextual changes that could impact the distribution of human capital in the Italian population, and thus confound the analysis, is limited. In order to provide additional confirmation of this claim, we run a regression discontinuity analysis, and obtain the same results (see Appendix B).

relative difference between lower and higher human capital founders before and after reform. As the institutional change was put in place on the national level, we include in our models a vector of dummies for Italian regions on NUTS 2 level in order to control for unobservable structural variance between different areas of the country that may locally impact entrepreneurial dynamics. We additionally introduce a vector of dummies for industrial sectors the startups belong to based on NACE classification, with the aim of controlling for intrinsic yet unobservable differences between industrial sectors.[9] As our data are available on the individual-, founder-level, we estimate the models allowing for company-level clustering of the errors, that is, allowing for correlation in the error terms between the cofounders.

In particular, in order to test Hypothesis 1, we estimate a logit model where the dependent variable is an indicator that separates entrepreneurs depending on whether they founded a company before or after the reform. The main interest is to understand the impact of founder's human capital, which in turn will explain if the reform as a whole has attracted founders endowed with relatively higher human capital. As robustness checks, we perform two additional tests. First, we exploit the panel data structure to estimate a pooled logit model, which allows us to better control for possible endogeneity issues. Secondly, we carry out a Cox event-history analysis. We define a "failure" event as the year when the entrepreneur starts a company (by the nature of our dataset, we have no censored data). The advantage of the Cox model is that it allows for a fairly flexible specification as it uses a semi-parametric estimation. In both cases, the interest lies in the interaction between the human capital variables and a dummy variable that indicates the time period after the policy. While Ai and Norton (2003) suggest that the magnitude of the interaction effect in non-linear models does not necessarily reflect its marginal effect, in the DID non-linear analysis here described (and the ones detailed below), it is shown by Puhani (2012) and further extended by Eesley (2016, see his online appendix) that the coefficient of the interaction term fully accounts for the treatment

[9] As an additional robustness check, we also include year-specific dummy variables in the pooled logit models to control for nation-wide shocks and trends that shape income distribution over time. We find consistent results.

effect of interest, provided that the two-way interaction term is formed by a treatment dummy (which is the case here).

In order to test Hypotheses 2 and 3, we use a similar approach. We estimate the logit model with a reform variable adjusted for the specific instruments it implemented related to the growth of the startups. Namely, we multiple the previously used dummies with another binary variable that records if an entrepreneur has used or plans to use the specific growth-related benefits. By doing that, we are able to measure if an entrepreneur had in mind the reform instruments intended to decrease growth barriers when starting the company. For Hypotheses 2 and 3, as robustness checks, we repeat pooled logit model estimation and Cox survival analysis. However, in order to conduct an even more rigorous test and better understand which instruments truly impact the inflow of (specific) high human capital into entrepreneurship, we estimate another pooled logit model, with more precise explanatory variables related to the reform. We create two binary variables: one that captures whether an entrepreneur founded the company after the policy and she has used only the entry-related instruments of the reform, and the other that records whether an entrepreneur founded the company after the policy and she has also used growth-related instruments. In all the cases, the major interest resides in the interaction between the human capital variables and the two created dummy variables.

Finally, in order to test Hypothesis 4, we use Ordinary Least Square (OLS) estimation with the logarithm of total sales in the last year of observation (2015) as the dependent variable. We use the same set of explanatory variables as in the previous analyses related to founding activity, with an addition of a few relevant control variables (to control for the age and incubation experience of the companies). Moreover, we again focus on the interaction terms between the specific human capital and the growth-related reform variables. Additionally, as the observed period is relatively short and might not allow all startups to deploy their full potential, we alternatively test whether the growth-related instruments of the reform

impact high-growth ambitions of entrepreneurs, and the results yield not to be different from the original model (see Appendix C).

Measures

Dependent variables

Founding event. In order to test Hypotheses 1-3, we deploy two different dependent variables depending on the estimation model. First, for the purpose of the logit models, we use two binary measures: *Founded after reform* that equal 1 if an entrepreneur started the company after the reform (and zero otherwise), and *Founded after growth reform* if an entrepreneur started the company after the reform and has used or intends to use its growth instruments (and zero otherwise). Second, for the purpose of the pooled logit and Cox models, a dichotomous variable *Foundation* is built that equals 1 if an entrepreneur founded the company in the given year (and zero otherwise).

Company performance. In order to test Hypothesis 4, we use a logarithm of *Total sales* as a measure of performance. Sales rate has been widely used in the entrepreneurship literature and is beneficial for several reasons. First, as company's *Age* is controlled for in the model, total sales at available year is a proxy of the average yearly absolute sales growth since foundation (for a similar approach, see e.g. Colombo and Grilli 2005). Second, total sales is a favorable measure to capture company performance in terms of growth when compared to the number of employees or profitability due to considerably less discrepancy across industries (Eberhart et al. 2017). This is particularly true for young companies, which are typically operating without (or no substantial) profits and on an extremely prudent number of employees for a fairly long period of time. A potential issue with this measure might emerge from the short time span we are able to observe, and the sales measure at year 2015 might be structurally different as new companies in some sectors might require considerably longer time to achieve revenues (e.g. high-tech manufacturing). In order to cope with this issue, in the robustness checks (see Appendix C) we

introduce an alternative proxy of (potential) performance quality that should not require varying (or particularly long) time intervals to show – R&D expenditures as percentage of total sales.

Explanatory variables

Human capital. The explanatory variables are built on the same principles extensively used in previous studies to describe the human capital endowments of entrepreneurs (e.g. see Colombo and Grilli 2005, 2010). In particular, we create the variable *Human capital* that comprises total years of university education and work experience prior to foundation (see e.g. Beckman *et al.* 2007; Eisenhardt and Schoonhoven 1990). Following our theoretical reasoning, we also break down this measure in the two components – generic and specific human capital. The measure of *Generic human capital* sums years of university education, freelance work experience, and employment in other sectors from the sector in which the founded company operates. On the other hand, *Specific human capital* is a measure of total years of entrepreneurial and managerial experience, and years of employment in the same sectors of founded company's activity. The operationalization of the two variables closely follows previous studies in the field (Colombo and Grilli 2005, Ganotakis 2012, Garrone et al. 2018).[10]

Reform. Depending on the estimation method, we use differently built explanatory variables related to the reform. First, for the cross-section analysis (OLS performance models) we use a pair of variables related to foundation (used as dependent variables in the logit models) – *Founded after reform* and *Founded after growth reform*. Second, for the pooled logit models, we build another batch of binary variables; *Post reform* that equals 1 in the years after the reform (and 0 before the reform), *Post entry reform* that equals 1 in the years after the reform for the firms that have used only the entry instruments

[10] Colombo and Grilli (2005, p. 796): "Generic human capital relates to the general knowledge acquired by entrepreneurs through both formal education and professional experience. Specific human capital consists of capabilities that founders can directly apply to the entrepreneurial job in the newly created firm. These include knowledge of the industry in which the new firm operates, that is *industry-specific* human capital obtained by founders through prior work experience in the same industry. They also include knowledge of how to manage a new firm, that is *entrepreneur-specific* human capital; this is developed by founders through "leadership experience" (Bruderl et al. 1992) obtained either through a managerial position in another firm or in prior self-employment episodes."

of the reform (and 0 otherwise), and *Post growth reform* that equals 1 in the years after the reform for the firms that have used also the growth instruments of the reform (and 0 otherwise).

Controls

We follow previous studies of founding determinants and performance of new ventures to complement the specification of the econometric model. The international experience of founders is likely to affect entrepreneurial decision-making processes (e.g. Hutchinson, Quinn, and Alexander 2006; Reuber and Fischer 1997), so we include an *International experience* index that is built on student, work and entrepreneurial experience abroad gained by entrepreneurs in the past (the higher the value, the greater the international experience). Then, female entrepreneurs are less common when compared to male entrepreneurs (e.g. Minniti and Nardone 2007), so we include a dichotomous gender variable *Gender male*, which equals 1 if the entrepreneur is male and 0 otherwise. Another stream of literature has argued that parents' experience impact entrepreneurial entry and behavior (e.g. Cooper and Dunkelberg 1986; Greve and Salaff 2003). Hence, we control for whether one of the founder's parents has had any entrepreneurial experience (dummy variable *Parent entrepreneur* equals 1 if one of the parents was an entrepreneur, and 0 otherwise). Founding team size is also accounted for by including a continuous variable *Founding team size* that equals the number of operative cofounders. Then, as firm performance is strictly related to the availability of resources (Barney 1991), we also control in the performance model for the participation of founder's company in an incubator (*Incubated*), which should enable YICs to access more easily some of key resources. Finally, apart from the firm-level controls, we also add to the model relevant macro-environmental variables. Namely, we control for total entrepreneurship rate on a NUTS2 regional level (*TEA*), which should corroborate our analysis in line with the set hypotheses that are intended to understand if the reform changes the quality and not the quantity of the national entrepreneurial ecosystem. *TEA* is sourced from the Regional Global Entrepreneurship Monitor (GEM), and is time-invariant in the cross-sectional analysis (fixed to the value in the year of company foundation)

and time varying in the panel structure. We also control for annual Gross Domestic Product (GDP) per capita rate.

Results

Descriptive statistics

Table 2 presents descriptive statistics among the key variables used in the study, as well as their correlation matrix based on 4,055 founders of 1,769 YICs. As expected, most of the founders are based in large city areas (12.93% in Milan, 7.9% in Rome, 6.1% in Turin), and are active in information technology (31.47%) and scientific research and development (17.54%) sectors. One may notice interestingly similar means of the two types of human capital (on average, a single founder has around 9.5 years of generic and around 9.8 years of specific experience). Furthermore, the high ratio of male representation reflects the strikingly low engagement of women in entrepreneurship (only around 18%), a common and concerning fact. A remarkably high percentage of founders (close to 20%) have at least one parent with entrepreneurial experience, speaking in 74favour of the importance that family culture plays in entrepreneurship as a professional choice. No particular correlations are large in magnitude, hence eliminating concerns of potential multi-collinearity that might affect our results.

-- Table 2 around here --

Table 3 provides means and standard deviations, as well as information regarding statistical difference between two subsamples – entrepreneurs who founded their ventures before (542) and after (3,513) the reform. It is noteworthy to remark there is an increase of women entrepreneurs after the reform, from 15 to almost 18 percent. The drop in total sales is expected due to the age differential between the two groups, as we measure the variable in year 2015. By looking at the means of the human capital variables, the surge in the overall level after the reform can be mainly attributed to the increase in the level of the

specific experience of the founders. Similar trends can also be observed in Figure 1, which presents distribution of high human capital founders (75th percentile and beyond) along foundation years.

-- Table 3 and Figure 1 around here --

Institutional change and founders' human capital

The first set of results, testing Hypothesis 1 that posits that the institutional reform that removes barriers to entrepreneurship increases the propensity of individuals endowed with high human capital to found a new venture, is presented in Table 4. The first column (Model 4a) reports estimates of the logit models. The coefficients of the variables explain which characteristics of the founders (or the external environment) impact the probability of foundation after the reform. Hypothesis 1 predicts that high human of founders will be more prone to found a new venture after the reform, which is indicatively supported in Model 4a with a positive and statistically significant (at the one percent level) coefficient of the *Human capital* variable. The next two columns of Table 4 report robustness checks performed on a longitudinal structure of the data, by the estimation of the pooled logit (Model 4b) and Cox (Model 4c) models. In this case, as the dependent variable is a dummy which equals one if the firms were founded in the given year, and zero otherwise, and the model specification includes the *Post reform* variable, coefficients related to human capital have a distinctive interpretation. Specifically, the interest does not solely lie in the direct effect of human capital variables, where the associated coefficient reflects the human capital endowment of pre-reform entrepreneurs compared to post-reform ones, but it rather resides in their interactions with the *Post reform* variable (see Eesley 2016). To be in line with our hypothesis, by the means of this specification, we expect a negative sign for the direct effect of human capital and a positive one for the interaction terms of the human capital variables with the *Post reform* variable. The findings fully comply with this pattern and, therefore, they are totally in line with the findings of the logit model estimations, providing further support for Hypothesis 1.

-- Table 4 around here --

Hypothesis 2 predicts that propensity of high human capital founders will increase as a consequence of reduction of growth barriers by the reform. To test this, the same set of analyses was repeated, with the only difference that now *Post reform* variable is substituted with the variable *Post growth reform*. The latter variable is a dummy that equals one only if a founder founded the firm after the policy and has used or plans to use growth related instruments of the reform. Otherwise, this dummy variable equals zero for a founder who founded the firm before the policy or after the policy but has not used and plans not to use the growth-related measures. Results reported in Table 5 indicate confirmation of Hypothesis 2. Individuals endowed with high levels of human capital are found to be more prone to become entrepreneurs after the growth reform was introduced. The coefficient of the human capital variable is significant at the one percent level. Results are confirmed by looking at the interaction terms of the pooled logit model (Model 5b) and (to a lesser extent in terms of statistical significance) of the Cox model (Model 5c).

-- Table 5 around here –

Further on, when a more sophisticated measure of human capital is used, the results presented in Table 6 display that the growth reform has managed to impact only founders with high specific human capital (significant at the one percent level), while no particularly significant influence (p=0.189) is found for the ones with high generic human capital. The effect of human capital is not only significant from a statistical point of view but it is also remarkable in economic terms. Looking at Model (6a), *ceteris paribus* (i.e. other independent variables at the median or mean value), an individual entrepreneur located near Rome and active in the information technology services sector (the benchmark case in our estimates), and characterized by high specific human capital (90^{th} percentile of the corresponding variable) is +32.68 percent more likely than the same individual characterized by low specific human capital (10^{th} percentile

of the corresponding variable) to have become an entrepreneur after the reform. Again the robustness checks presented in the same table (Models 6b and 6c) fully comply with this result.

-- Table 6 around here --

To provide further evidence that are especially the growth rather than the entry instruments of the introduced institutional change to drive high human capital individuals into entrepreneurship, we perform an additional check on the panel structure of the data. As previously explained, we use two binary variables *Post entry reform* and *Post growth reform*. They capture whether an entrepreneur founded the company after the policy and she has used its entry-related instruments only, and whether an entrepreneur founded the company after the policy and she has used growth-related instruments, respectively. Table 7 reports the results of the pooled logit model, with the main coefficient of interest being the interaction terms. The results corroborate the confirmation of Hypotheses 2 and 3. Even though coefficients corresponding to both entry and growth instruments are positive, only growth-related instruments appear to have a strongly statistically significant effect (at the one percent level) on the foundation decision of high human capital founders (see Models 7a and 7c), and particularly on those characterized by a high specific component (see Models 7b and 7d).

-- Table 7 around here --

Institutional change, founders' human capital and growth of new ventures

Table 8 shows the results of OLS regressions of total sales on reform introduction and human capital variables, as well as control variables. The first two columns (Models 8a and 8b) do that on the full sample of founders, while the third and fourth column (Models 8c and 8d) are estimated on a sample of founders without the ones that founded their ventures in year 2015. The last four columns (Models 8e, 8f, 8g and 8h) present the same estimations, only based on the firm- rather than on the founder-level. In all the models, the coefficients of interest correspond to the interaction terms between the reform and human

capital variables. The results provide supporting evidence for Hypothesis 4, which proposes that removing growth barriers by means of an institutional reform will increase the difference in terms of growth performance between firms founded by individuals with low specific human capital and firms founded by individuals with high specific human capital. In particular, founders endowed with the high levels of specific human capital perform better in terms of their venture growth after the institutional reform. The coefficient of the specific human capital variable is significant at 7.9 percent level. To that end, taking as reference estimates of the Model (8b), before the reform, a low or great level of *Specific human capital* does not make any difference in terms of the YICs' sales (the corresponding coefficient is not statistically different from zero). While after the reform, everything else being equal (i.e., other independent variables at the median or mean value), moving the variable *Specific human capital* from its 10^{th} to the 90^{th} percentile leads to a surge in sales performance of +29.82 percent.

-- Table 8 around here --

The alternative measure of ventures' growth potential or rather ventures' ambition (i.e. R&D expenditures) have shown comparable results too, which advocates for validation of Hypothesis 4. The results for R&D expenditures as the dependent variable are presented in Appendix C.

Robustness analyses and additional evidence

In order to assure robustness of the findings, we perform additional checks. We repeat all key estimations by excluding from the sample the founders who founded ventures in the period around the reform. In particular, we leave out founders who created their ventures in the immediate pre- and post-neighborhood of the reform (six months before and after November 2012). By doing this, we rule out the possibility that pre-reform entrepreneurs found their firm because they had the capacity to foresee with certainty the implementation of the policy. Moreover, we rule out that, because the founding of a firm is a process rather than an event, those entrepreneurs who founded their firms immediately after the policy

was implemented, had instead decided to become entrepreneurs before the policy. We should point out that the former possibility is highly unlikely in the first place, given the great uncertainty surrounding the Italian political system (e.g. the Italian Republic has been characterized by the highest rate of cabinet turnover in Western Europe in the last fifty years, see, for instance, Curini 2011). The obtained results are fully in line with the results obtained on the complete sample, which provides further support for the reliability of the findings (the results are presented in Appendix C).

Then, as already mentioned in footnote no. 8, we also adopt a regression discontinuity design and apply the opposite logic of the one exposed above: in particular, we perform our investigation by only considering the time periods immediately before and immediately after the institutional change, thus to alleviate any possible concerns about potential confounding factors at the institutional level. We run several regressions based on different pre- and post-reform time windows and all confirmed our findings (the results are also presented in Appendix C).

Additionally, we delve further into the specific human capital measure. First, it is worthwhile looking deeper into specific human capital variable to discover which features truly matter in the context of our study. We elicited entrepreneurial experience from the other elements of the specific work experience measure. The obtained results confirm the finding that the introduced institutional change increased the propensity of entrepreneurs with the experience in the same sector of activity as well as serial entrepreneurs to found new ventures. This result rules out the possibility that our results are driven by serial entrepreneurs only and that the institutional change had simply allowed them to fail faster and create new business ventures. Though serial entrepreneurship is also a relevant phenomenon, our analysis points to the power of the institutional change to attract new highly skilled individuals to start their own ventures.

Lastly, we provide additional insights into how different growth instruments of the reform impact the entry. We group them in two major sub-categories – funding instruments and employee's human capital instruments. The obtained results (see Appendix D) point out that both growth instruments are relevant in attracting high human capital founders, yet reduction of funding obstacles appears to have a stronger effect.

Discussion and conclusions

The extant literature based on the institutional theory has provided a wide body of evidence on how institutional change can impact firm entry and thus influence the quantity of entrepreneurs. We instead put forward a different, arguable equally important role of institutional change for entrepreneurship – we posited that a certain type of institutional reform may impact the quality of entrepreneurship by attracting founders equipped with better human capital.

We developed a set of hypotheses on the impact of institutional change on founders' human capital, and consequently on the performance of their ventures. We tested them using seven years of data on a comprehensive sample of founders of new Italian innovative startups created before and after a milestone reform, and found (a) that institutional change that reduces barriers to entrepreneurship increases propensity of high human capital individuals to become entrepreneurs, (b) that the instruments that reduce growth barriers in particular have a more significant impact than those directed to reduce entry barriers, (c) it is the specific rather than the generic human capital component which is the most incentivized by the growth barriers removal and (d) that there is a super-additive effect between the institutional change and founders' specific high human capital on the performance of the firms created after the reform.

Our findings provide several contributions to the literature. First, we add to the intersection of the institutional theory and entrepreneurship literature by shedding light on how institutional change can

impact entrepreneurship through different theoretical mechanisms. Previous studies highlight entry barriers as a pivotal mechanism influencing founding rates (Dobbin and Dowd 1997, Klapper et al. 2006, Meek et al. 2010, Sine and Lee 2009). Eesley (2016) and Eberhart *et al.* (2017) do introduce and test alternative mechanisms (growth and exit barriers, respectively). However, they do not confront these mechanisms within the same institutional reform. We do exactly that, and show that lowering barriers to growth rather than barriers to entry has a prominent relevance for entrepreneurship and potentially economic and social growth. Related to that point, we study the effect of an institutional change on the previously neglected individual-level. In particular, unlike the previous literature that has focused on organizations or industries, we inspect whether an institutional reform distinctively affects different types of individuals. We center our attention on the impact on founders with high levels of different types of human capital. This group of skilled prospective entrepreneurs is a preferential target as they are also found to be more likely to succeed in their new business endeavors. By being able to clearly isolate effects of different instruments, we find that reducing barriers to growth attracts to entrepreneurship the high specific human capital individuals, who are considered the most likely to succeed in knowledge-intensive sectors. This approach provides a more nuanced view of the effect an institutional change can have on entrepreneurial entry that goes beyond the direction (i.e. the rate) but rather qualifies the type of individuals that seize entrepreneurial opportunities as a consequence of an institutional change. Furthermore, we also add to the literature stream by theorizing and showing evidence of both direct and indirect impacts of institutional change on firm growth, which postulates the relevance and capacity of the institutional change. The extant institutional studies on entrepreneurship typically only deal with the effect on new venture rates and survival taking into account a decrease in barriers to entry (Djankov et al. 2002, Sine et al. 2005, Sine and Lee 2009). Instead, similarly to Eesley (2016), yet in a different institutional context, we show how lowering barriers to growth enhances venture growth directly, as well as through attracting high human capital entrepreneurs. Interestingly, the findings show that the reform has the most

significant impact on entrepreneurs who have vast specific work experience with respect to the founded venture.

Second, we also add to the entrepreneurship literature by complementing several research streams. The first group of studies has inspected individual characteristics that lead the individuals to entrepreneurial activity (e.g. see Blanchflower and Oswald 1998; Cooper and Dunkelberg 1986; Shane 2000). Another group of studies has dealt with determinants of entrepreneurial ventures' success, such as founders characteristics and experience (Åstebro and Thompson 2011, Colombo and Grilli 2005, 2010). We add to these two streams by connecting them, i.e. by showing that the institutional change not only engages a relatively increased number of these highly skilled individuals, but they are also the ones who benefit the most from the structural reduction of the barriers in growing their businesses. By that, we bring to light the fact that institutions are an antecedent of the two, and a determinant factor in fostering high quality entrepreneurship. Particularly, we demonstrate that institutional change, and reduction of growth barriers more specifically, can create an appealing environment for the right type of entrepreneurs (Ahuja and Yayavaram 2011, Khanna and Palepu 2005), who have great specific human capital and thus are more likely to succeed. In doing so, we also shed new light on the organizational imprinting and population ecology perspectives (Hannan et al. 1996, Hannan and Freeman 1977) by revealing an important multi-level impact of external conditions for organizations dynamics (Marquis and Tilcsik 2013). First, we confirm that features of external environment do imprint firms at their foundation that represents a key *sensitive moment* of organization's existence (e.g. Geroski et al. 2010, Shinkle and Kriauciunas 2012). Second, we find that changes in these external conditions are capable of significantly and immediately affecting the nature of the firms in the pool, and again through imprinting effects, can have persistent effects on a population's dynamics. In other terms, if extant firms' characteristics may evolve slowly and path-dependently from an initial imprinting, the industrial sectors are not necessarily subjected to the same inertia and might experience swifter (positive) changes driven by an institutional change. Thus,

resembling Stinchcombe (1965, p.159) and his hypothesis that a correlation may exist between the age at which industries were originally developed and their structure at present time, we suggest that this correlation may be weak or strong, depending on the institutional changes occurring in the mean time. In this respect, new tech-based sectors here considered, being innovation-driven, might be more genetically prone to respond to institutional changes than other more traditional industries taken into consideration by Stinchcombe (e.g. agriculture). Further research in this vein would be welcome to better understand to what extent institutional changes can moderate the aforementioned correlation in different sectors.

Besides, this study also offers relevant implications for public policy. Most importantly, the findings suggest that regulators may impact the quality of entrepreneurship, and produce positive effects even in the short term. By reducing barriers to entrepreneurship, policy makers may improve the incentive structure for prospective entrepreneurs, especially the ones with high human capital endowments, who have reciprocally more lucrative professional alternatives. Additionally, our study provides evidence that regulators may influence entrepreneurship dynamics by reducing both types of barriers to entrepreneurship, yet the findings emphasize a relatively more significant impact of removing barriers to growth. Indeed, considering the scarce resources policy makers could have at their disposal these days, our analysis suggests that an order of priorities can be set: introducing growth related benefits such as more flexible labour regulations, beneficial tax credit for the employment of highly skilled personnel, incentives for equity investors and debt providers are potentially the most effective measures in pushing the talented individual towards the innovative entrepreneurship career's path. Moreover, these policy dimensions will not only have the capacity to increase the number of highly skilled entrepreneurs, but they will also facilitate higher growth performance of the newly created ventures.

Nevertheless, due to the single country focus of our study, a question of generalizability of the findings arises. In this respect, if replication in other institutional contexts will admittedly bring robustness to the results here exposed, it is also important to note that the dramatic effect that a reduction in the barriers

to growth may induce on entrepreneurial dynamics that we document here is qualitatively the same as the one obtained by Eesley (2016) in China in a completely diverse time frame. Combining this with the observation that we do not pose any strict and context-specific assumption on the development of the theoretical reasoning, there is a realistic expectation that these empirical effects will hold in general and only the magnitude may vary across countries. Moreover, we anticipate that our findings transcend beyond Italy particularly well in institutional environments where cultural traits about entrepreneurship are similar, specifically in Western Europe (Audretsch *et al.* 2002).[11] Another aspect we have not been able to cover in our study is the decrease of the exit barriers, due to the inability to measure whether the founders took into consideration the exit instruments of the reform (questionnaire did not include this question). Hence, a part of the explanatory power of the other two types of policy instruments (entry and growth) might be associated to the exit-related instruments. Nonetheless, even though we are not able to rule out this possibility, we do not expect that portion to be so substantial to countervail the relative importance of growth vs. entry barriers removal we highlighted in this study.

To conclude, our study offers a well-grounded understanding of how institutions influence the creation and growth of firms in the early stage of their existence. In doing so, it stresses the importance that changeable institutions may have for public policy directed at economic growth and job creation. In particular, this study clearly shows how policy makers can influence *"who is playing"*, i.e. who is becoming an entrepreneur, where the typology of players–whether they are highly skilled or not, greatly impacts on the prosperity of an economic system. In fact, high quality prospective entrepreneurs react to and benefit from the changes in their institutional environment that remove barriers that otherwise impede their high potential business activities to fully develop.

[11] For instance, Italy alike other Western European countries (e.g. France, Spain, Germany) ranks high on Hofstede's *uncertainty avoidance index*, which has been shown to be a key entrepreneurial trait.

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Figures and Tables

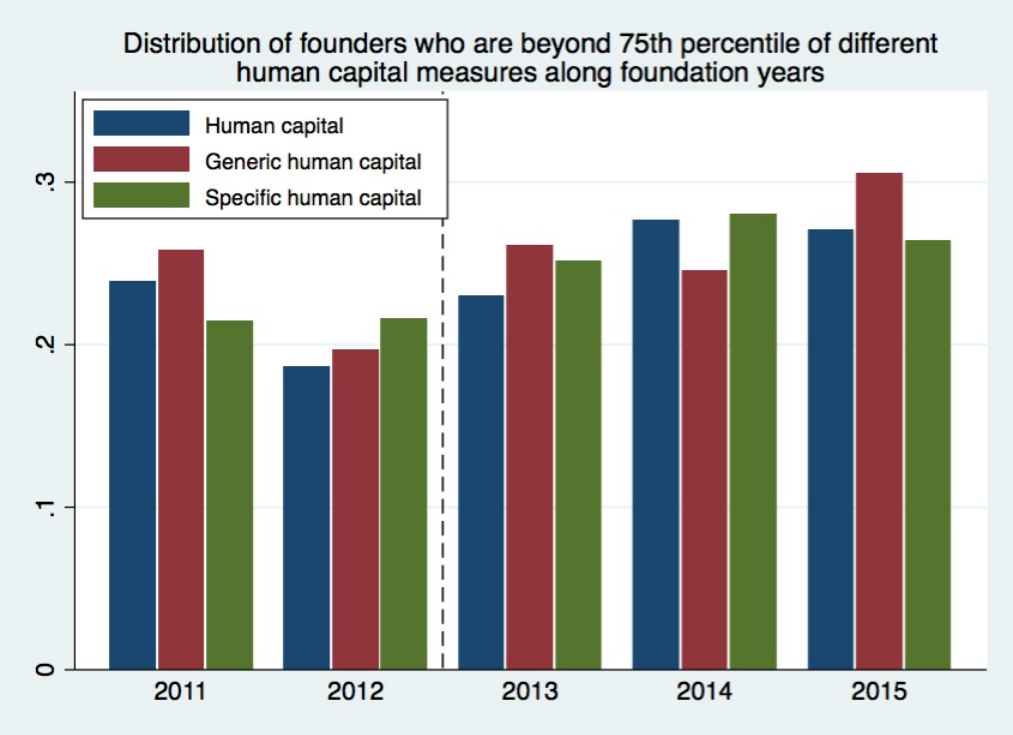

Figure 1.Distribution of high human capital founders (75th percentile and beyond) along foundation years.
The dashed vertical line indicates the reform event.

Table 1. Description and taxonomy of the instruments implemented in 2012 under the Startup Act intended to facilitate the creation of YICs in the Italian economy.

Instrument group	Instrument definition
Entry instruments	• Decrease of startup costs
	• Decrease of startup time (incorporation procedure simplification)
Growth instruments	• Flexible labour regulations (less rigid contract requirements)
	• Dynamic salary (performance-based compensation option)
	• Stock / equity compensation option
	• Tax credit for the employment of highly skilled personnel
	• Incentives for equity investors
	• Incentives for debt providers (government guaranteed bank loans)
	• Internationalization support
	• Incentives for equity crowdfunding
Exit instruments	• "Fail fast" procedure (simplification of liquidation procedure without suffering significant reputational and financial costs)

Table 2. Means, standard deviations and mutual correlation among the key variables.

Variable	Mean	St. Dev.	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*
(1) Founded after reform	0.867	0.338	1													
(2) Founded after growth reform	0.735	0.441	0.785	1												
(3) Total sales	115,395	319,260	−0.171	−0.139	1											
(4) Human capital	19.276	11.848	0.046	0.056	0.011	1										
(5) Generic human capital	9.451	9.867	−0.005	0.001	0.002	0.351	1									
(6) Specific human capital	9.825	12.494	0.047	0.054	0.009	0.680	−0.448	1								
(7) International experience	0.317	0.583	−0.006	0.026	−0.007	0.118	−0.015	0.124	1							
(8) Gender male	0.817	0.386	−0.045	−0.038	0.032	0.098	−0.019	0.108	0.059	1						
(9) Parent entrepreneur	0.193	0.395	0.001	0.022	0.004	0.015	0.037	−0.015	0.036	−0.008	1					
(10) Founding team size	2.925	2.250	0.075	0.114	−0.019	−0.028	0.018	−0.041	−0.037	−0.044	−0.105	1				
(11) GDP per capita	35,378	639.375	−0.082	−0.061	0.034	0.002	0.006	−0.002	−0.004	0.010	−0.013	0.010	1			
(12) TEA	0.040	0.021	0.155	0.102	−0.038	−0.070	−0.056	−0.024	−0.020	−0.044	0.008	−0.006	−0.045	1		
(13) Age	1.188	1.157	−0.817	−0.660	0.193	−0.053	0.004	−0.053	−0.007	0.045	−0.001	−0.084	−0.231	−0.014	1	
(14) Incubated	0.297	0.457	0.031	0.032	−0.096	−0.081	−0.029	−0.054	−0.001	−0.047	0.004	0.103	−0.066	0.022	−0.013	1

Notes: Statistics are based on 4,055 founders (of 1,769 YICs born from 2009 to 2015, yielding 28,381 observations in longitudinal terms); *Total sales* variable is logged in the analyses.

Table 3. Statistical difference between the two groups of founders on the key variables.

Variable	Founded before reform (No. of founders: 542; No. of observations: 3,794)		Founded after reform (No. of founders: 3,513; No. of observations: 24,591)		Difference (*p*-value)
	Mean	**St. Dev.**	**Mean**	**St. Dev.**	
Total sales	193,640	436,047	83,906	250,994	− (0.000)
Human capital	17.959	10.980	19.480	11.964	+ (0.002)
Generic human capital	9.145	9.114	9.498	9.977	0 (0.213)
Specific human capital	8.813	10.945	9.982	12.710	+ (0.020)
International experience	0.316	0.563	0.317	0.586	0 (0.397)
Gender male	0.851	0.356	0.812	0.390	− (0.016)
Parent entrepreneur	0.183	0.387	0.194	0.396	0 (0.326)
Founding team size	2.683	1.584	2.961	2.333	+ (0.002)
Age	3.390	0.512	0.842	0.791	− (0.000)
Incubated	0.260	0.439	0.303	0.459	+ (0.022)

Notes: *Total sales* variable is logged in the analyses.

Table 4. Institutional change and human capital of founders.

Analysis type	Logit models	Pooled logit models	Cox models
Model	**(4a)**	**(4b)**	**(4c)**
Dep. variable	***Founded after reform***	***Foundation***	***Foundation***
Human capital	0.015 ***	−0.010 **	−0.009 **
	(0.005)	(0.004)	(0.004)
	[0.005]	[0.017]	[0.027]
Post reform		1.734 ***	11.409
		(0.135)	/
		[0.000]	/
Post reform		0.013 **	0.008 *
x Human capital		(0.004)	(0.004)
		[0.011]	[0.072]
International experience	−0.071	0.003	−0.016
	(0.110)	(0.004)	(0.024)
	[0.520]	[0.428]	[0.529]
Gender male	−0.373 **	0.003	0.056 *
	(0.159)	(0.008)	(0.033)
	[0.019]	[0.674]	[0.092]
Parent entrepreneur	−0.009	−0.010	0.001
	(0.151)	(0.009)	(0.034)
	[0.952]	[0.222]	[0.997]
Founding team size	0.085 *	0.001	−0.013
	(0.046)	(0.002)	(0.010)
	[0.067]	[0.634]	[0.221]
GDP per capita		0.001 ***	0.000
		(0.000)	/
		[0.000]	/
TEA	27.466 ***	13.837 ***	4.390 **
	(9.486)	(2.794)	(1.950)
	[0.004]	[0.000]	[0.024]
Const.	−2.862	−43.919 ***	
	(2.275)	(3.548)	
	[0.208]	[0.000]	
Industry dummies	Included	Included	Included
Regional dummies	Included	Included	Included
Observations	3420	28381	15514
Founders	3420	4055	4051
Companies	1497	1769	1766
Log. likelihood	−1311.988	−955.924	−31396.795
Pseudo R^2 / Wald Chi^2	0.114	0.181	1.27×10^{10}

Notes: The number of observations varies between models due to the relatively fine-grained taxonomies of industries (NACE Rev. 2 intermediate aggregation) and regions (Nuts 2 level), which yields no variation in the dependent variables within some of the groups. The regressions were repeated with a higher level of aggregation of the control variables and similar results are obtained, providing support for the consistency of the results. GDP per capita in the Cox model is included as a time-varying control. The reported standard errors (in parenthesis) are robust standard errors clustered by company. STATA does not report standard errors for (some) time-varying variables in the Cox model due to the presence of collinearity. *p*-values are shown in the square brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% level.

Table 5. Reduction of growth barriers and human capital of founders.

Analysis type	Logit models	Pooled logit models	Cox models
Model	**(5a)**	**(5b)**	**(5c)**
Dep. variable	***Founded after growth reform***	***Foundation***	***Foundation***
Human capital	0.013 ***	−0.007 ***	−0.006 **
	(0.004)	(0.002)	(0.003)
	[0.002]	[0.002]	[0.021]
Post growth reform		1.689 ***	−0.065
		(0.061)	(0.080)
		[0.000]	[0.416]
Post growth reform		0.008 ***	0.005
x Human capital		(0.002)	(0.003)
		[0.001]	[0.104]
International experience	0.097	−0.017	−0.016
	(0.092)	(0.017)	(0.025)
	[0.292]	[0.341]	[0.528]
Gender male	−0.314 ***	0.062 ***	0.057 *
	(0.117)	(0.022)	(0.034)
	[0.007]	[0.006]	[0.088]
Parent entrepreneur	0.276 **	−0.060 ***	−0.001
	(0.115)	(0.022)	(0.010)
	[0.016]	[0.007]	[0.997]
Founding team size	0.143 ***	−0.021 ***	−0.013
	(0.041)	(0.006)	(0.010)
	[0.000]	[0.002]	[0.214]
GDP per capita		0.001 ***	−0.000
		(0.000)	/
		[0.000]	/
TEA	15.547 **	15.340 ***	4.336 **
	(6.740)	(2.493)	(1.954)
	[0.021]	[0.000]	[0.026]
Const.	−1.634	−46.020 ***	
	(1.593)	(2.983)	
	[0.305]	[0.000]	
Industry dummies	Included	Included	Included
Regional dummies	Included	Included	Included
Observations	3420	28381	15514
Founders	3420	4055	4051
Companies	1497	1769	1766
Log. likelihood	−2041.675	−9524.356	−31397.575
Pseudo R^2 / Wald Chi^2	0.1009	0.1844	3.03×10^{13}

Notes: The number of observations varies between models due to the relatively fine-grained taxonomies of industries (NACE Rev. 2 intermediate aggregation) and regions (Nuts 2 level), which yields no variation in the dependent variables within some of the groups. The regressions were repeated with a higher level of aggregation of the control variables and similar results are obtained, providing support for the consistency of the results. GDP per capita in the Cox model is included as a time-varying control. The reported standard errors (in parenthesis) are robust standard errors clustered by company. STATA does not report standard errors for (some) time-varying variables in the Cox model due to the presence of collinearity. *p*-values are shown in the square brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% level.

Table 6. Reduction of growth barriers and specific human capital of founders.

Analysis type	Logit models	Pooled logit models	Cox models
Model	**(6a)**	**(6b)**	**(6c)**
Dep. variable	***Founded after growth reform***	***Foundation***	***Foundation***
Generic human capital	0.007	−0.004	−0.007 **
	(0.006)	(0.003)	(0.004)
	[0.189]	[0.147]	[0.048]
Specific human capital	0.016 ***	−0.008 ***	−0.006 **
	(0.005)	(0.003)	(0.003)
	[0.000]	[0.001]	[0.043]
Post growth reform		1.699 ***	−0.070
		(0.062)	(0.082)
		[0.000]	[0.390]
Post growth reform		0.006 *	0.006
x Generic human capital		(0.003)	(0.004)
		[0.056]	[0.153]
Post growth reform		0.009 ***	0.004
x Specific human capital		(0.003)	(0.003)
		[0.001]	[0.162]
International experience	0.089	−0.015	−0.016
	(0.092)	(0.017)	(0.025)
	[0.332]	[0.395]	[0.552]
Gender male	−0.327 ***	0.065 ***	0.056 *
	(0.118)	(0.023)	(0.034)
	[0.005]	[0.004]	[0.094]
Parent entrepreneur	0.284 **	−0.062 ***	0.001
	(0.115)	(0.022)	(0.034)
	[0.013]	[0.006]	[0.994]
Founding team size	0.146 ***	−0.021 ***	−0.013
	(0.041)	(0.007)	(0.010)
	[0.000]	[0.001]	[0.220]
GDP per capita		0.001 ***	−0.000
		(0.000)	/
		[0.000]	/
TEA	15.460 **	15.346 ***	4.334 **
	(6.766)	(2.494)	(1.953)
	[0.022]	[0.000]	[0.027]
Const.	−1.583	−46.036 ***	
	(1.587)	(2.984)	
	[0.318]	[0.000]	
Industry dummies	Included	Included	Included
Regional dummies	Included	Included	Included
Observations	3420	28381	15514
Founders	3420	4055	4051
Companies	1497	1769	1766
Log. likelihood	−2039.826	−9523.668	−31397.490
Pseudo R^2 / Wald Chi^2	0.1017	0.1845	4.9×10^8

Notes: The number of observations varies between models due to the relatively fine-grained taxonomies of industries (NACE Rev. 2 intermediate aggregation) and regions (Nuts 2 level), which yields no variation in the dependent variables within some of the groups. The regressions were repeated with a higher level of aggregation of the control variables and similar results are obtained, providing support for the consistency of the results. GDP per capita in the Cox model is included as a time-varying control. The reported standard errors (in parenthesis) are robust standard errors clustered by company. STATA does not report standard errors for (some) time-varying variables in the Cox model due to the presence of collinearity. *p*-values are shown in the square brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% level.

Table 7. Reduction of entry and growth barriers, and human capital of founders.

Analysis type	Pooled logit models		Cox models	
Model	**(7a)**	**(7b)**	**(7c)**	**(7d)**
Dep. variable	***Foundation***		***Foundation***	
Human capital	−0.010 **		−0.009 **	
	(0.004)		(0.004)	
	[0.015]		[0.024]	
Generic human capital		−0.008		−0.008
		(0.006)		(0.006)
		[0.157]		[0.193]
Specific human capital		−0.011 **		−0.010 **
		(0.004)		(0.004)
		[0.013]		[0.020]
Post entry reform	0.960 ***	0.960 ***	0.007	−0.018
	(0.200)	(0.206)	/	/
	[0.000]	[0.000]	/	/
Post growth reform	2.014 ***	2.019 ***	−0.005	−0.008
	(0.108)	(0.112)	(0.085)	(0.086)
	[0.000]	[0.000]	[0.950]	[0.926]
Post entry reform	0.012		0.006	
x Human capital	(0.008)		(0.005)	
	[0.126]		[0.246]	
Post growth reform	0.011 ***		0.008 *	
x Human capital	(0.004)		(0.004)	
	[0.009]		[0.082]	
Post entry reform		0.012		0.001
x Generic human capital		(0.011)		(0.007)
		[0.268]		[0.876]
Post growth reform		0.010 *		0.006
x Generic human capital		(0.006)		(0.006)
		[0.099]		[0.377]
Post entry reform		0.012		0.009
x Specific human capital		(0.008)		(0.006)
		[0.160]		[0.115]
Post growth reform		0.012 ***		0.008 *
x Specific human capital		(0.004)		(0.004)
		[0.009]		[0.064]
International experience	−0.011	−0.010	−0.021	−0.021
	(0.012)	(0.012)	(0.025)	(0.025)
	[0.357]	[0.411]	[0.403]	[0.401]
Gender male	0.044 **	0.046 ***	0.048	0.046
	(0.017)	(0.017)	(0.032)	(0.032)
	[0.011]	[0.008]	[0.138]	[0.153]
Parent entrepreneur	−0.047 ***	−0.048 ***	0.019	0.019
	(0.017)	(0.017)	(0.032)	(0.032)
	[0.005]	[0.004]	[0.560]	[0.555]
Founding team size	−0.015 ***	−0.015 ***	−0.014	−0.014
	(0.005)	(0.005)	(0.010)	(0.010)
	[0.002]	[0.002]	[0.182]	[0.190]
GDP per capita	0.001 ***	0.001 ***	−0.002	−0.000
	(0.000)	(0.000)	/	/
	[0.000]	[0.000]	/	/
TEA	13.683 ***	13.685 ***	4.442 **	4.438 **
	(2.767)	(2.766)	(1.953)	(1.952)
	[0.000]	[0.000]	[0.024]	[0.023]
Const.	−44.523 ***	−44.533 ***		
	(3.629)	(3.629)		
	[0.000]	[0.000]		
Industry dummies	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included
Observations	28381	28381	15514	15514
Founders	4055	4055	4051	4051
Companies	1769	1769	1766	1766
Log. likelihood	−9367.779	−9367.489	−31317.557	−31316.846
Pseudo R^2 / Wald Chi^2	0.1991	0.1992	4.38×10^{7}	3.36×10^{14}

Notes: The reported standard errors (in parenthesis) are robust standard errors clustered by company. STATA does not report standard errors for (some) time-varying variables in the Cox model due to the presence of collinearity. *p*-values are shown in the square brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% level.

Table 8. Reduction of growth barriers, human capital of founders and new ventures growth.

Analysis type	OLS		OLS		OLS		OLS	
Model	(8a)	(8b)	(8c)	(8d)	(8e)	(8f)	(8g)	(8h)
Dep. variable	*Total sales log*		*Total sales log*		*Total sales log*		*Total sales log*	
Human capital	−0.014		−0.018 **		−0.008		−0.018	
	(0.009)		(0.009)		(0.011)		(0.012)	
	[0.106]		[0.040]		[0.474]		[0.127]	
Generic human capital		−0.025 *		−0.035 **		−0.022		−0.037 *
		(0.015)		(0.016)		(0.019)		(0.020)
		[0.099]		[0.031]		[0.255]		[0.072]
Specific human capital		−0.008		−0.012 ***		−0.002		−0.011
		(0.008)		(0.009)		(0.011)		(0.011)
		[0.282]		[0.157]		[0.840]		[0.322]
Founded after growth ref.	−0.220	−0.228	−0.561 *	−0.578 *	−0.013	−0.070	−0.432	−0.509
	(0.246)	(0.257)	(0.298)	(0.304)	(0.262)	(0.278)	(0.320)	(0.334)
	[0.373]	[0.376]	[0.060]	[0.058]	[0.962]	[0.802]	[0.177]	[0.129]
Founded after growth ref. x Human capital	0.019 *		0.023 **		0.011		0.021	
	(0.010)		(0.011)		(0.013)		(0.014)	
	[0.050]		[0.038]		[0.386]		[0.141]	
Founded after growth ref. x Generic human cap.		0.021		0.029		0.023		0.037
		(0.016)		(0.018)		(0.020)		(0.023)
		[0.179]		[0.120]		[0.278]		[0.114]
Founded after growth ref. x Specific human cap.		0.017 *		0.020 *		0.005		0.014
		(0.009)		(0.011)		(0.012)		(0.014)
		[0.079]		[0.063]		[0.654]		[0.296]
International experience	−0.301 ***	−0.314 ***	−0.274 **	−0.294 ***	−0.275 ***	−0.282 ***	−0.227 *	−0.237 *
	(0.086)	(0.087)	(0.110)	(0.111)	(0.099)	(0.098)	(0.126)	(0.125)
	[0.001]	[0.000]	[0.013]	[0.008]	[0.005]	[0.004]	[0.073]	[0.059]
Gender male	0.027	0.009	0.058	0.035	−0.071	−0.085	−0.063	−0.086
	(0.109)	(0.110)	(0.132)	(0.133)	(0.159)	(0.162)	(0.207)	(0.211)
	[0.804]	[0.937]	[0.658]	[0.792]	[0.655]	[0.600]	[0.762]	[0.683]
Parent entrepreneur	−0.091	−0.084	−0.063	−0.044	−0.077	−0.068	−0.034	−0.013
	(0.122)	(0.121)	(0.145)	(0.145)	(0.143)	(0.144)	(0.168)	(0.170)
	[0.454]	[0.489]	[0.663]	[0.759]	[0.591]	[0.635]	[0.842]	[0.941]
Founding team size	−0.050	−0.048	−0.060	−0.056	−0.033	−0.031	−0.029	−0.024
	(0.051)	(0.051)	(0.067)	(0.067)	(0.040)	(0.040)	(0.051)	(0.051)
	[0.331]	[0.342]	[0.376]	[0.401]	[0.408]	[0.439]	[0.571]	[0.634]
Age	0.879 ***	0.880 ***	0.493 ***	0.502 ***	0.874 ***	0.876 ***	0.483 ***	0.492 ***
	(0.072)	(0.072)	(0.120)	(0.120)	(0.062)	(0.062)	(0.100)	(0.100)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Incubated	−0.329 **	−0.330 **	−0.474 **	−0.476 **	−0.412 ***	−0.412 ***	−0.560 ***	−0.559 ***
	(0.151)	(0.151)	(0.189)	(0.188)	(0.125)	(0.125)	(0.156)	(0.156)
	[0.030]	[0.029]	[0.012]	[0.012]	[0.001]	[0.001]	[0.000]	[0.000]
TEA	1.790	1.639	0.452	0.279	0.817	0.835	−1.390	−1.473
	(3.430)	(3.428)	(4.522)	(4.505)	(2.987)	(2.993)	(3.862)	(3.861)
	[0.602]	[0.633]	[0.920]	[0.951]	[0.785]	[0.780]	[0.719]	[0.703]
Const.	0.327	0.399	1.347	1.423	0.374	0.451	1.503	1.598
	(1.273)	(1.291)	(1.229)	(1.249)	(1.314)	(1.258)	(1.146)	(1.165)
	[0.797]	[0.757]	[0.273]	[0.255]	[0.763]	[0.720]	[0.190]	[0.169]
Industry dummies	Included	Included	Included	Included	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included	Included	Included	Included	Included
Observations	2709	2709	1884	1884	1175	1175	814	814
Companies	1175	1175	814	814	1175	1175	814	814
R^2	0.2876	0.2899	0.1970	0.2018	0.2947	0.2962	0.1933	0.1968

Notes: Models 8a and 8b are regressed on the full sample of founders. Models 8c and 8d are regressed on a subsample of founder excluding the ones that founded the company in 2015, in which case total sales in 2015 is not a relevant measure of growth (in fact, no measure is). Models 8e-8h are regressed on a subsample of companies instead of founders, where measures are averaged from the founders level. The number of observations varies between models due to the relatively fine-grained taxonomies of industries (NACE Rev. 2 intermediate aggregation) and regions (Nuts 2 level), which yields no variation in the dependent variables within some of the groups. The regressions were repeated with a higher level of aggregation of the control variables and similar results are obtained, providing support for the consistency of the results. The reported standard errors (in parenthesis) are robust standard errors clustered by company. *p*-values are shown in the square brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% level.

Appendix

CONTENT

Appendix A: Data and sample

This study is based on data collected by the National Committee of the Italian Ministry for Economic Development (MISE) on the "Monitoring and Evaluation of National policies for the Eco-system of Italian Innovative Start-ups" and administered by the Italian National Institute of Statistics (ISTAT) in 2016. The survey was designed in order to enhance the qualitative side of the available data about the young innovative companies (YICs) in Italy, which goes beyond the traditional register data already available (quantitative aspects like the number of startups launched, the personnel and shareholders involved, the geographical and sector distribution and so on).

All the innovative startups listed in the special registry of young innovative startups as of December 31st 2015 (5,150 companies) were mailed in March 2016 with the goal of creating the first national statistical survey of innovative startups. The survey was administered during April and May 2017 and has been concluded on May 27th 2017. Most of the surveyed companies were located in the north of Italy (31.2% in the North West and 26.8% in the North East), while the other areas were also well represented (22% in the South and 20% in the Centre). The companies were mainly active in providing services (79.6%). In particular, 29.7% produced software, 16.4% operated in research, 6.9% in data processing and 5.3% in commerce and tourism. The remaining 20.4% operated in industry (including construction), and of these 3.5% produce innovative machinery. Around 10% of the registered companies were generating more than €500,000, 30.1% between 100,000 and 500,000, and the rest recorded a value of production of up to €100,000 in the last year.

The survey enquired information along a series of dimensions including the human capital endowment of the founding teams, their innovation strategies, firm growth performances and, also, entrepreneurs' assessment of the public policy measures that were put in place in this domain. As to this latter aspect, entrepreneurs were explicitly asked regarding the institutional reform and individual measures put in place. Specifically, the entrepreneurs were enquired to declare whether they had already used or intend to use the particular instruments of the implemented reform. We used this

information to determine which aspects of the institutional change influenced their decision to become entrepreneurs, and in turn, which aspects helped them grow their businesses.

Sample representativeness

Out of the total population of the startups that the questionnaire was send to, 2,275 completed it. This represents a response rate of over 44% and is a very significant percentage for a voluntary statistical survey. The exceptionally high portion of completed questionnaires offers a unique opportunity to study a wide group of heterogonous young innovative companies, unlike studies that focus on more specific subgroups (e.g. companies founded by university graduates, companies invested or investigated by a single association or organization, etc.) Furthermore, the sample is ensured to be representative of the population on all dimensions on which ISTAT has information on both sides, i.e. population and sample, including firms' geographic location, industry affiliation, age and legal status. See the MISE (2016) report for more details. We were able to extract full information for our key variables of interest for 1,769 YICs (35% of the total population, still a fairly high percentage). We ran chi-squared tests between the surveyed population and the final sample of YICs and the results show high levels of representativeness of the latter (e.g. $\chi^2_{Nuts\ 2\ level} = 0.46\ (p - value = 1.000)$, $\chi^2_{NACE\ Rev.2} = 4.54\ (p - value = 0.999)\ and\ \chi^2_{Age} = 1.09\ (p - value = 0.955)$). The regional, yearly and sectoral distributions are shown in Table A1, Table A2 and Table A3, respectively. The assured representativeness of the sample alleviates doubts regarding potential response bias.

Survivorship bias

Another concern with the data is a potential survivorship bias since the companies are not sampled at their birth. Instead, we are able to include in the survey only the companies that had survived until the moment of the survey, and we are not able to recover the information on the companies that had failed to that date. These unobserved (failed) companies might have different characteristics from the ones we can observe. Moreover, for the same reason, we have an unbalanced representativeness of the companies with respect to their age – we certainly have more nascent companies than companies

that are 4-5 years old (as higher number of older companies had failed before the survey was conducted).

There are two mechanisms that could be in place due to this bias in our context. The first one is based on evolutionary and competence-based theories of the firm and would work in favor of our findings. Namely, the entrepreneurship literature has argued and shown that companies founded by high human capital founders survive longer (i.e. fail less) than the companies founded by low human capital founders (e.g. Unger et al. 2011). If that was the case, high human capital founders would indeed be overrepresented in the older companies (and hence the ones founded before the reform), and would bias the results against (and not for) our findings. The second mechanism is more concerning, though less probable. In that alternative scenario, high human capital founders are more prone and faster to fail their startups and move on to other more promising labour options such as employment or another more promising entrepreneurial opportunity (e.g. Gimeno et al. 1997). If that was the case, high human capital founders would indeed be underrepresented in the older companies (and hence the ones founded before the reform), and could potentially falsely bias our results in the direction of our findings.

In order to assure that our findings are indeed not driven by this unavoidable discrepancy, we run several tests. First, we try to infer the failure (survival) hazard of the companies in our sample based on their observable characteristics. We add to our data information on the survival of companies exactly one year after the survey took place (May 2017) drawing from AIDA database (provided by Bureaux Van Dick which reports complete financial accounting data for public and private Italian firms), and conduct a two-stage procedure. We first regress this dichotomous variable on a set of features of the companies and founders using a probit estimator, which allows us to estimate the inverse mills ratio (IMR). Then, at the second stage, we repeat all the estimations from the main analysis adding the IMR variable in the specification, controlling for the probability of failure. The

obtained results stay unchanged, while the coefficient of IMR yield to be insignificant. See Table A4 for details.

Second, we use the same information to run a simulation based on semi-random deletion of companies from our sample, with the goal of making a more balanced data that reassembles the one without any survivorship bias. In order to do so, by looking into the newly added information on the survival of companies to May 2017, we approximate the probability of survival of the companies conditional on their age (see Table A5). The survival rates are relatively higher than the ones available in general statistics, which is to be expected for innovative companies (Colombelli et al., 2016). Using this information, we randomly, yet disproportionally (depending on their age) eliminate companies from our sample in such a way to have a more comparable number of companies for each age group (we eliminate to a lesser degree the older companies, as they are already underrepresented in our sample; for example, we eliminate more than 20% of the companies founded in 2015, and only 2.4% of companies founded in 2011) and repeat the full analysis. We reiterate this exercise for a number of times (we used 50 repetitions) and then average out the key result of interest related to human capital (see the average coefficient value, standard error and p-value in Table A6). Furthermore, in order to address the second mechanism that could adversely bias our results, we also created a scenario with unbalanced failures of founders with high versus low human capital (2 times more failures of the former). The results of this check are presented in Table A7. In either case, we obtained the same findings as in the main analysis, assuring the survivorship bias is not confiding them. If the low failure rates cast some doubt on the approximation of the results, we repeat both tests with Eurostat data on firm survival in Italy during the period 2010-2015 (startups active in broad business economics, see Table A8). Unchanged results are obtained (see Table A9 and Table A10).

Third, we repeat the first check based on a two-stage procedure using an alternative dataset on Italian young innovative companies – RITA (see for instance Colombo and Piva, 2012). RITA is a dataset that provides similar information on high-tech companies up to 2008. We build the same variables we used

in the case of our data, and use this data to calculate the IMR in the two-stage procedure, as well as the age-by-age failure rates in the simulation. The obtained results are completely symmetrical (see Table A11). Furthermore, descriptive statistics regarding survival rate and human capital in the RITA dataset suggests the first mechanisms above is stronger. Namely, founders of failed firms in RITA have significantly less human capital endowments (12.73 versus 14.26 years of specific experience). Similarly, failed companies indeed have less cumulative specific human capital, as it may be seen from Figure A1.

Last but not least, we conducted regression discontinuity analysis (see *infra* for more details) that also points in the direction of no serious issue caused by the survivorship bias. The concerns regarding the issue of survivorship bias are hence fairly minimized.

Appendix B: Empirical design

A potentially worrying issue in our empirical setting is the fact that we do not have data on individuals who do not found a firm. An ideal research design would be: use a sample of Italian individuals, some of whom found firms and some of whom do not, see how their human capital predicts whether they found a firm, then examine how the effect of human capital changes in the years pre- and post-reform. As we do not have data on non-founders, we test Hypotheses 1-3 by estimating a logit model that predicts whether the founder created her firm before or after the reform, and interpret a positive relationship between this dependent variable and the human capital of the founder. The key assumption we are making is that the distribution of human capital in the Italian population is remaining the fairly unchanged over the entire sample period (2009-2015). This assumption is rather credible, as not other major reform has been put in place that could influence human capital in Italy. Likewise, the observed time frame is too narrow to expect that the Startup Act has indirectly induced a change in human capital by making the innovative entrepreneurship more attractive to such extent to influence accumulation of human capital (and specific human capital, in particular). Nevertheless, to cope more tangible with this issue, we also run the pooled logit estimates, and observe the

interaction between human capital and post-policy indicator in a difference-in-difference setting. In that way, we compare the difference between conditional expectation of the observed outcome Y (company entry) for high versus low human capital founders after the reform, and the conditional expectation of the counterfactual outcome Y_0 (company entry) for high versus low human capital founders before the reform. This should eliminate the concern of not having data on non-founders.

Nonetheless, in order to further corroborate our findings, we run a regression discontinuity analysis based only on the founders and companies founded closely around the introduction of the institutional change, which allows us to estimate the (local) average treatment effect. We check different time windows (3 months before and after, 6 months, 12 months, 18 months and 24 months). The results presented in Table B1 confirm our initial findings that the reform indeed does positively impact the entry of high human capital founders.

Appendix C: Robustness analysis

In order to corroborate our findings, we opt for several other robustness checks. First, we repeat all key estimations by excluding from the sample the founders who founded ventures in the period around the reform (the opposite from the regression discontinuity design). In particular, we leave out founders who created their ventures in the immediate pre- and post-neighborhood of the reform (six months before and after November 2012). By doing this, we rule out the possibility that pre-reform entrepreneurs found their firm because they had the capacity to foresee with certainty the implementation of the policy. Moreover, we rule out that, because the founding of a firm is a process rather than an event, those entrepreneurs who founded their firms immediately after the policy was implemented, had instead decided to become entrepreneurs before the policy. We should point out that the former possibility is highly unlikely in the first place, given the great uncertainty surrounding the Italian political system (e.g. the Italian Republic has been characterized by the highest rate of cabinet turnover in Western Europe in the last fifty years, see, for instance, Curini, 2011). The obtained

results presented in Table C1 are fully in line with the results obtained on the complete sample, which provides further support for the reliability of the findings.

Second, we also provide a robustness check of the findings regarding growth of the ventures (Hypothesis 3). Namely, the length of the observation period is relatively short for the ventures to observe their growth by looking into their total sales. Therefore, we use alternative measures that should proxy ventures' growth potential or rather ventures' ambition (i.e. R&D expenditures, internationalization, external funding). The results of these checks have shown comparable results too, which advocates for validation of Hypothesis 3. The results for R&D expenditures are presented in Table C2, while the remaining ones are available upon request from the authors.

Appendix D: Additional evidence

Different types of human capital

It is worth looking deeper into the specific human capital variable to discover which features of experience truly matter in the context of our study. Therefore, we break down specific human capital into its two components: work experience in the same sector of new venture's activity and entrepreneurial experience. The results are shown in Table D1. The main findings are unchanged – the institutional change does indeed increase the propensity of individuals with the experience in the same sector of activity as well as serial entrepreneurs to found new ventures. This result rules out the possibility that our results are driven by serial entrepreneurs only and that the institutional change had simply allowed them to fail faster and create new business ventures. Though serial entrepreneurship is also a relevant phenomenon, our analysis points to the power of the institutional change to attract new highly skilled individuals to start their own ventures.

Different types of growth instruments

Furthermore, we unpack the growth instruments put in place by the reform. In particular, we group them in two major categories – funding instruments and employee's human capital instruments. The distinction seems relevant for two reasons. On the one hand, funding is widely argued to be one of

the key obstacles for growing companies and decreasing the monetary burden of scaling a business could be perceived by highly skilled individuals as a deal-breaker to found a new venture. On the other hand, highly skilled founders might find acquisition of employees endowed with high human capital very challenging, since their start-up could be perceived as less attractive than other employment options, given the untested nature of the business idea that they propose and the lack of a track record for the new borne firm. Funding instruments encompass incentives for equity investors, debt providers and equity crowdfunding. Employee's human capital instruments comprise flexible labour regulations, performance-based, stock or equity employee compensation options, and tax credit for the employment of highly skilled personnel. The obtained results are presented in Table D2. Both types of growth instruments appear to be relevant in attracting high human capital founders, yet reduction of funding obstacles yield to be more statistically significant.

Appendix: References

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Appendix: Tables and figures

Table A1. Regional distribution of the companies in the final sample (1,769 firms) and the surveyed population (5,150 firms).

No.	Region (Nuts 2)	Final sample (%)	Population (%)
1	Abruzzo	2.39	2.27
2	Basilicata	0.74	0.68
3	Calabria	2.19	2.35
4	Campania	6.03	6
5	Emilia-Romagna	11.23	11.13
6	Friuli-Venezia Giulia	2.16	2.52
7	Lazio	10.22	9.94
8	Liguria	1.74	1.61
9	Lombardia	22.84	22.12
10	Marche	5.61	4.8
11	Molise	0.44	0.39
12	Piemonte	6.09	6.74
13	Puglia	3.96	3.84
14	Sardegna	2.63	2.64
15	Sicilia	4.82	4.68
16	Toscana	5.52	5.67
17	Trentino-Alto Adige	2.9	3.4
18	Umbria	1.39	1.48
19	Valle D'aosta	0.21	0.21
20	Veneto	6.91	7.53
Chi-squared test		$\chi^2_{Nuts\ 2\ level} = 0.46$	$p - value = 1.000$

Table A2. Yearly distribution of the companies in the final sample (1,769 firms) and the surveyed population (5,150 firms).

No.	Region (Nuts 2)	Final sample (%)	Population (%)
1	2010	0.28	0.52
2	2011	5.38	4.8
3	2012	8.73	9.15
4	2013	17.96	19.78
5	2014	33.94	29.78
6	2015	33.71	35.97
Chi-squared test		$\chi^2_{Age} = 1.09$	$p - value = 0.955$

Table A3. Sectoral distribution of the companies in the final sample (1,769 firms) and the surveyed population (5,150 firms).

No.	Sector of activity (NACE Rev. 2)	Final sample (%)	Population (%)
1	A 01 Coltivazioni Agricole E Produzio..	0.06	0.23
2	A 02 Silvicoltura Ed Utilizzo Di Aree..	0.005	0.06
3	C 10 Industrie Alimentari	0.34	0.6
4	C 11 Industria Delle Bevande	0.11	0.08
5	C 13 Industrie Tessili	0.17	0.19
6	C 14 Confezione Di Articoli Di Abbigl..	0.23	0.25
7	C 15 Fabbricazione Di Articoli In Pel..	0.11	0.25
8	C 16 Industria Del Legno E Dei Prodot..	0.23	0.27
9	C 17 Fabbricazione Di Carta E Di Prod..	0.11	0.17
10	C 18 Stampa E Riproduzione Di Support..	0.06	0.14
11	C 20 Fabbricazione Di Prodotti Chimici	0.91	0.74
12	C 21 Fabbricazione Di Prodotti Farmac..	0.28	0.23
13	C 22 Fabbricazione Di Articoli In Gom..	0.74	0.54
14	C 23 Fabbricazione Di Altri Prodotti ..	0.17	0.21
15	C 24 Metallurgia	0.005	0.21
16	C 25 Fabbricazione Di Prodotti In Met..	0.91	0.6
17	C 26 Fabbricazione Di Computer E Prod..	4.48	3.84
18	C 27 Fabbricazione Di Apparecchiature..	1.76	2.14
19	C 28 Fabbricazione Di Macchinari Ed A..	3.91	3.36
20	C 29 Fabbricazione Di Autoveicoli, Ri..	0.34	0.45
21	C 30 Fabbricazione Di Altri Mezzi Di ..	0.91	0.83
22	C 31 Fabbricazione Di Mobili	0.11	0.31
23	C 32 Altre Industrie Manifatturiere	1.36	1.26
24	C 33 Riparazione, Manutenzione Ed Ins..	0.34	0.35
25	D 35 Fornitura Di Energia Elettrica, ..	1.02	1.2
26	E 36 Raccolta, Trattamento E Fornitur..	0.06	0.02
27	E 38 Attivita' Di Raccolta, Trattamen..	0.06	0.35
28	E 39 Attivita' Di Risanamento E Altri..	0.005	0.08
29	F 41 Costruzione Di Edifici	0.23	0.31
30	F 42 Ingegneria Civile	0.005	0.04
31	F 43 Lavori Di Costruzione Specializz..	0.79	0.76
32	G 45 Commercio All'ingrosso E Al Dett..	0.06	0.14
33	G 46 Commercio All'ingrosso (Escluso ..	1.53	1.84
34	G 47 Commercio Al Dettaglio (Escluso ..	2.1	2.33
35	H 49 Trasporto Terrestre E Trasporto ..	0.005	0.02
36	H 52 Magazzinaggio E Attivita' Di Sup..	0.06	0.25
37	H 53 Servizi Postali E Attivita' Di C..	0.17	0.12
38	I 55 Alloggio	0.005	0.06
39	I 56 Attivita' Dei Servizi Di Ristora..	0.17	0.39
40	J 58 Attivita' Editoriali	1.93	2.19
41	J 59 Attivita' Di Produzione, Post-Pr..	0.45	0.54
42	J 60 Attivita' Di Programmazione E Tr..	0.17	0.08
43	J 61 Telecomunicazioni	0.68	0.54
44	J 62 Produzione Di Software, Consulen..	31.56	30.19
45	J 63 Attivita' Dei Servizi D'informaz..	7.14	8.19
46	K 64 Attivita' Di Servizi Finanziari ..	0.11	0.14
47	K 66 Attivita' Ausiliarie Dei Servizi..	0.005	0.04
48	M 69 Attivita' Legali E Contabilita'	0.005	0.12
49	M 70 Attivita' Di Direzione Aziendale..	3.57	2.97
50	M 71 Attivita' Degli Studi Di Archite..	4.31	3.44
51	M 72 Ricerca Scientifica E Sviluppo	15.98	15.18
52	M 73 Pubblicita' E Ricerche Di Mercato	1.13	1.55
53	M 74 Altre Attivita' Professionali, S..	4.42	3.84
54	M 75 Servizi Veterinari	0.005	0.02
55	N 77 Attivita' Di Noleggio E Leasing ..	0.68	0.5
56	N 78 Attivita' Di Ricerca, Selezione,..	0.06	0.1
57	N 79 Attivita' Dei Servizi Delle Agen..	0.45	0.76
58	N 80 Servizi Di Vigilanza E Investiga..	0.005	0.02
59	N 81 Attivita' Di Servizi Per Edifici..	0.11	0.04
60	N 82 Attivita' Di Supporto Per Le Fun..	1.42	1.86
61	P 85 Istruzione	0.57	0.64
62	Q 86 Assistenza Sanitaria	0.28	0.27
63	Q 87 Servizi Di Assistenza Sociale Re..	0.005	0.06
64	Q 88 Assistenza Sociale Non Residenzi..	0.45	0.31
65	R 90 Attivita' Creative, Artistiche E..	0.17	0.19
66	R 91 Attivita' Di Biblioteche, Archiv..	0.06	0.04
67	R 93 Attivita' Sportive, Di Intratten..	0.11	0.16
68	S 95 Riparazione Di Computer E Di Ben..	0.11	0.04
69	S 96 Altre Attivita' Di Servizi Per L..	0.17	0.27
Chi-squared test		$\chi^2_{NACE\ Rev.2} = 4.54$	$p - value = 0.999$

Table A4. Two-stage logit and pooled logit models based on Inverse Mills ratio estimated from the Startup Act dataset.

Analysis type **Model** **Dep. variable**	**Logit** **(A4a)** ***Founded after reform***	**Pooled logit** **(A4b)** ***Foundation***
Generic human capital	0.012	−0.009
	(0.007)	(0.006)
	[0.118]	[0.126]
Specific human capital	0.020	−0.011
	(0.006)	(0.004)
	[0.003]	[0.012]
Post growth reform		1.749
		(0.139)
		[0.000]
Post growth reform ***x Generic human capital***		0.011 (0.007) [0.125]
Post growth reform ***x Specific human capital***		0.014 (0.005) [0.012]
International experience	−0.192	−0.001
	(0.359)	(0.001)
	[0.594]	[0.355]
Gender male	−0.329	0.001
	(0.171)	(0.001)
	[0.053]	[0.386]
Parent entrepreneur	0.066	0.001
	(0.170)	(0.001)
	[0.053]	[0.190]
Founding team size	0.080	0.001
	(0.051)	(0.001)
	[0.117]	[0.636]
GDP per capita		0.001
		(0.000)
		[0.000]
TEA	25.608	13.864
	(9.815)	(2.797)
	[0.009]	[0.000]
Inverse Mills ratio	0.947	0.013
	(0.905)	(0.013)
	[0.295]	[0.299]
Const.	−2.864	44.032
	(2.369)	(3.559)
	[0.227]	[0.000]
Industry dummies	Included	Included
Regional dummies	Included	Included
Observations	3420	28353
Founders	3420	4050
Companies	1497	1767
Log. likelihood	−1304.5147	−9507.832
Pseudo R^2 / Wald Chi^2	0.1195	0.1824

Notes: The reported standard errors (in parenthesis) are robust standard errors clustered by company. *p*-values are shown in the square brackets.

Table A5. Survival rates based on the extended Startup Act Survey dataset.

Survival rate	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
May 2016 - May 2017	93.6%	95.0%	95.1%	94.1%	96.3%	97.6%
Cumulative	93.6%	88.9%	84.6%	79.6%	76.6%	74.8%

Notes: *Cumulative survival rate is approximated based on the survival rates from May 2016 to May 2017.*

Table A6. Simulation of the analysis after random exclusion of companies based on approximated age-by-age survival rates from the Startup Act dataset; 50 iterations.

No.	Generic Human Capital				Specific Human Capital			
	Coefficient	St. Err.	p-value		Coefficient	St. Err.	p-value	
1	0.0111088	0.0075821	0.1428859		0.0181881	0.0058839	0.0019937	***
2	0.0105697	0.007673	0.1683561		0.0167096	0.0058684	0.0044081	***
3	0.0122635	0.007625	0.1077662		0.0189298	0.0058598	0.0012359	***
4	0.0104812	0.0074035	0.156861		0.0178461	0.0058121	0.0021368	***
5	0.012575	0.0077298	0.1037752		0.0179256	0.0057961	0.0019835	***
6	0.0110053	0.0075656	0.1457654		0.0182011	0.0057822	0.0016451	***
7	0.0112286	0.0075501	0.1369599		0.01637	0.0058133	0.004863	***
8	0.0102438	0.0075662	0.175769		0.0186411	0.0058163	0.0013507	***
9	0.0107825	0.0076206	0.1570932		0.0177529	0.0058419	0.0023744	***
10	0.0097564	0.0076729	0.2035366		0.0171589	0.0058416	0.0033099	***
11	0.011672	0.007606	0.1248875		0.0166659	0.0057509	0.003756	***
12	0.0106384	0.0075649	0.1596422		0.0154107	0.0058187	0.0080862	***
13	0.0104613	0.0075678	0.1668671		0.0168561	0.0057814	0.0035504	***
14	0.011824	0.0077708	0.1281079		0.016151	0.0057892	0.0052729	***
15	0.0114658	0.0076943	0.1361783		0.0178488	0.0058449	0.0022599	***
16	0.0121988	0.0077708	0.1164593		0.0188147	0.0058127	0.0012086	***
17	0.0112293	0.0073388	0.1259836		0.0165606	0.0058221	0.0044488	***
18	0.0103663	0.0074731	0.1653931		0.0170567	0.0058137	0.0033475	***
19	0.0105339	0.0075104	0.1607444		0.0163079	0.0058386	0.0052205	***
20	0.0120906	0.0076201	0.1125868		0.0171359	0.0058147	0.0032086	***
21	0.0105604	0.0075691	0.1629541		0.0164916	0.0058364	0.0047189	***
22	0.013357	0.0074739	0.0739134	*	0.0183472	0.0058114	0.0015934	***
23	0.0121571	0.0076357	0.1113541		0.0174125	0.0057885	0.0026289	***
24	0.0112775	0.0074179	0.1284332		0.0174677	0.0057833	0.0025247	***
25	0.0134703	0.0077714	0.0830412	*	0.0184455	0.0057462	0.0013272	***
26	0.0078969	0.0075734	0.2970788		0.0158003	0.0057999	0.0064452	***
27	0.0110698	0.0076328	0.1469775		0.0177494	0.0058122	0.0022595	***
28	0.0099536	0.0075063	0.184826		0.01644	0.0058025	0.0046078	***
29	0.0135676	0.0074673	0.0692276	*	0.0183236	0.0058797	0.0018305	***
30	0.0105309	0.0075517	0.1631621		0.0162831	0.0058084	0.005057	***
31	0.0092354	0.0073831	0.2109777		0.0151693	0.0058394	0.0093838	***
32	0.0116276	0.0075963	0.1258464		0.0163763	0.0058156	0.0048634	***
33	0.0121324	0.0076603	0.1132412		0.016658	0.0058495	0.0044029	***
34	0.0125313	0.0077193	0.1045099		0.0169809	0.0059078	0.0040491	***
35	0.0095592	0.0075697	0.2066497		0.0168516	0.0058152	0.0037574	***
36	0.0100151	0.0076254	0.1890515		0.0169886	0.0058716	0.0038119	***
37	0.0099584	0.007563	0.1879352		0.0157283	0.0057476	0.0062096	***
38	0.0106121	0.0075623	0.1605318		0.0168902	0.0058574	0.0039323	***
39	0.0103162	0.007525	0.1703972		0.0161641	0.0058127	0.0054219	***
40	0.0112659	0.0075991	0.1381986		0.0163835	0.0057421	0.0043278	***
41	0.0142479	0.0077038	0.0643919	*	0.0203842	0.0058548	0.0004984	***
42	0.0117178	0.0076774	0.1269446		0.0161837	0.0058435	0.0056138	***
43	0.0121086	0.0075324	0.1079395		0.0163748	0.0057823	0.0046274	***
44	0.0103593	0.0074972	0.1670468		0.0176016	0.0058765	0.002742	***
45	0.0094881	0.0074748	0.2043196		0.0172765	0.0059334	0.0035945	***
46	0.0121779	0.0077156	0.1144823		0.0163235	0.005906	0.0057116	***
47	0.0107535	0.0076646	0.1606133		0.0170492	0.0059053	0.003888	***
48	0.0131516	0.0078264	0.0928778	*	0.0168077	0.0058713	0.0042004	***
49	0.0112701	0.0076779	0.1421401		0.0179978	0.0058394	0.0020553	***
50	0.0101064	0.0075597	0.1812636		0.017348	0.0058623	0.0030839	***
Average	0.0111794	0.0075928	0.1457189		0.0171366	0.0058281	0.0036966	***

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A7. Simulation of the analysis after random exclusion of companies biased toward elimination of two times more companies endowed with high human capital than the ones with low human capital, based on approximated age-by-age survival rates from the Startup Act dataset; 50 iterations.

No.	Generic Human Capital			Specific Human Capital			
	Coefficient	St. Err.	p-value	Coefficient	St. Err.	p-value	
1	0.0105958	0.0075577	0.1609194	0.016724	0.0057886	0.0038631	***
2	0.01057	0.0077471	0.1724507	0.0167118	0.0058009	0.0039656	***
3	0.0094885	0.0076564	0.2152383	0.015368	0.0058544	0.0086639	***
4	0.0102558	0.0075034	0.1716792	0.0156998	0.0057289	0.0061351	***
5	0.0072352	0.0076559	0.3446335	0.0136088	0.0058185	0.0193414	**
6	0.0087205	0.0075627	0.2488703	0.0153872	0.0058842	0.0089224	***
7	0.0087075	0.0074097	0.2399364	0.0155998	0.0058923	0.0081088	***
8	0.009632	0.0076321	0.2069356	0.0148186	0.0058603	0.0114509	**
9	0.0084114	0.0077002	0.2746776	0.0151367	0.0059679	0.0112008	**
10	0.0100393	0.0077103	0.1928947	0.0157314	0.0057938	0.006623	***
11	0.0086487	0.0075373	0.2511903	0.0142582	0.0057403	0.0129969	**
12	0.010363	0.007537	0.169148	0.0164397	0.0058	0.0045907	***
13	0.0095616	0.007642	0.2108659	0.0165539	0.0058569	0.0047074	***
14	0.0082948	0.0075499	0.2719122	0.0151469	0.0058489	0.0096055	***
15	0.009229	0.0075694	0.2227494	0.0150732	0.0058103	0.0094809	***
16	0.0100285	0.0075637	0.1848818	0.0157706	0.0058976	0.0074939	***
17	0.0099013	0.0075535	0.189919	0.0158429	0.0058159	0.0064486	***
18	0.0083719	0.0074306	0.2598808	0.0154158	0.0058664	0.0085937	***
19	0.0085757	0.0074549	0.2500006	0.0140776	0.0057063	0.013623	**
20	0.0099739	0.0076123	0.1901134	0.0162965	0.005892	0.0056774	***
21	0.0100156	0.0077184	0.1944187	0.0156515	0.0057979	0.0069439	***
22	0.0075953	0.007533	0.3133245	0.016172	0.0057129	0.0046434	***
23	0.0080292	0.0076244	0.2922961	0.0156641	0.0059793	0.0088004	***
24	0.0088001	0.007488	0.2399012	0.0148327	0.0059293	0.0123634	**
25	0.0072782	0.0075371	0.33422	0.0163393	0.0058456	0.0051874	***
26	0.0124731	0.0076913	0.104866	0.0163264	0.0057911	0.0048136	***
27	0.0108536	0.0076458	0.155738	0.0150588	0.0058073	0.0095122	***
28	0.0089307	0.0074159	0.2284901	0.0161997	0.0057903	0.0051462	***
29	0.0065837	0.0074303	0.3755784	0.0148404	0.0057871	0.0103349	**
30	0.01021	0.007569	0.1773649	0.0161198	0.0058084	0.0055156	***
31	0.0091356	0.0075231	0.2246143	0.0170335	0.0058352	0.0035103	***
32	0.0095546	0.007665	0.2125734	0.0139358	0.0057925	0.0161357	**
33	0.0120324	0.0076417	0.1153539	0.0169218	0.0058753	0.0039745	***
34	0.0084099	0.0076666	0.2726612	0.016754	0.0059186	0.0046438	***
35	0.0102122	0.0076437	0.1815378	0.0155224	0.0058494	0.0079623	***
36	0.0109004	0.0077064	0.157226	0.0172088	0.0058672	0.0033563	***
37	0.0091529	0.0074972	0.2221479	0.0150006	0.0058402	0.0102132	**
38	0.0081292	0.0075366	0.2807535	0.014927	0.0057259	0.0091354	***
39	0.0107005	0.0075929	0.1587529	0.0151558	0.0058333	0.0093726	***
40	0.0080684	0.0075994	0.288363	0.0140788	0.0059097	0.0172031	**
41	0.0100961	0.0077244	0.191198	0.0143444	0.0057202	0.0121537	**
42	0.0104131	0.0076442	0.1731249	0.0156988	0.0060039	0.0089286	***
43	0.0091219	0.0077008	0.2361957	0.0150352	0.0058253	0.0098512	***
44	0.0095075	0.0074215	0.2001641	0.015513	0.0057841	0.0073176	***
45	0.0082583	0.0076456	0.2800845	0.0147236	0.0058446	0.0117621	**
46	0.0091151	0.007523	0.225654	0.0154902	0.005739	0.0069529	***
47	0.0091596	0.0074596	0.2194859	0.0147486	0.0058426	0.0115926	**
48	0.0107666	0.0075872	0.1558881	0.0152443	0.0057924	0.0084943	***
49	0.0086732	0.0075486	0.2505628	0.0166221	0.0059498	0.0052107	***
50	0.0102499	0.0076117	0.1781095	0.0161478	0.0058422	0.0057095	***
Average	0.0093806	0.0075836	0.2213909	0.0155395	0.0058333	0.0083647	***

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A8. Survival rates based on the EUROSTAT dataset.

Survival rate	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
Cumulative	80.0%	63.0%	52.6%	47.0%	44.0%	42.5%

Notes: *Cumulative survival rate is approximated based on the survival rates from May 2016 to May 2017.*

Table A9. Simulation of the analysis after random exclusion of companies based on approximated age-by-age survival rates from the EUROSTAT dataset; 50 iterations.

No.	Generic Human Capital				Specific Human Capital			
	Coefficient	St. Err.	p-value		Coefficient	St. Err.	p-value	
1	0.0116485	0.0078287	0.136771		0.0162631	0.0059768	0.0065075	***
2	0.0065997	0.0075288	0.3807089		0.0155411	0.0058655	0.0080592	***
3	0.0117972	0.0076242	0.1217795		0.0162233	0.0059822	0.0066894	***
4	0.0104643	0.0076726	0.1726118		0.016449	0.0059174	0.0054394	***
5	0.0104161	0.0076373	0.1726165		0.0169748	0.0059202	0.0041401	***
6	0.0117137	0.0076799	0.1272006		0.0172188	0.0059469	0.0037867	***
7	0.0084627	0.0075915	0.2649513		0.0149313	0.0058579	0.0108056	**
8	0.0116171	0.0077968	0.1362285		0.0146924	0.0058098	0.0114412	**
9	0.0146398	0.0076635	0.0560902	*	0.0192417	0.0059779	0.0012873	***
10	0.010073	0.0078703	0.2005889		0.0171283	0.0059292	0.003867	***
11	0.0118204	0.0076831	0.1239275		0.0171267	0.0059192	0.0038109	***
12	0.0097539	0.0077596	0.2087486		0.0165396	0.0059221	0.0052241	***
13	0.0135552	0.0079159	0.0868242	*	0.0181608	0.0059123	0.0021286	***
14	0.0101573	0.007781	0.1917568		0.0178459	0.0058277	0.0021968	***
15	0.008908	0.0075604	0.238703		0.0163486	0.005902	0.0056057	***
16	0.0091751	0.00771	0.2340335		0.0163515	0.0058368	0.0050872	***
17	0.01259	0.0078007	0.1065375		0.0182017	0.005931	0.0021483	***
18	0.0098801	0.0076671	0.1975285		0.0173307	0.005961	0.0036452	***
19	0.0110702	0.007482	0.1389824		0.0167439	0.0057758	0.0037437	***
20	0.0118234	0.0076489	0.1221625		0.0171426	0.0058761	0.0035302	***
21	0.0085089	0.007591	0.2623256		0.0142865	0.0058877	0.0152448	**
22	0.0135944	0.0079172	0.0859662	*	0.0164007	0.005922	0.0056148	***
23	0.0127949	0.0076141	0.0928771	*	0.0172424	0.0057887	0.0028954	***
24	0.0100714	0.007724	0.1922676		0.0159758	0.0058919	0.0066987	***
25	0.0079121	0.0076187	0.2990335		0.0154414	0.0059256	0.0091637	***
26	0.0112641	0.0074911	0.1326663		0.0155575	0.0059796	0.0092748	***
27	0.0123504	0.0076391	0.1059354		0.0165599	0.0059465	0.0053554	***
28	0.0117042	0.0078294	0.1349402		0.0187518	0.0059354	0.0015814	***
29	0.0126229	0.0075427	0.0942224	*	0.0173113	0.005832	0.0029941	***
30	0.0103618	0.0077815	0.182993		0.0172882	0.0057609	0.0026915	***
31	0.0127382	0.0075234	0.0904286	*	0.01904	0.005767	0.0009615	***
32	0.0113833	0.0078595	0.1475182		0.0166578	0.0058313	0.004282	***
33	0.0130155	0.0077459	0.0928984	*	0.0155455	0.0060386	0.0100429	**
34	0.0105402	0.0076874	0.1703463		0.0189824	0.0058686	0.0012182	***
35	0.0097176	0.007651	0.20405		0.0158714	0.0058586	0.006747	***
36	0.0085039	0.0076475	0.2661461		0.016654	0.005814	0.0041771	***
37	0.0113035	0.0076727	0.1406914		0.0155911	0.0058804	0.0080166	***
38	0.0090091	0.0077463	0.2448208		0.0164586	0.0058788	0.0051157	***
39	0.0127719	0.007346	0.0820992	*	0.0181091	0.0059761	0.0024433	***
40	0.0106019	0.0075053	0.157776		0.017574	0.0058828	0.002814	***
41	0.0125597	0.0077062	0.1031398		0.020612	0.0060116	0.0006064	***
42	0.0109565	0.0078463	0.162599		0.0166276	0.0060136	0.005692	***
43	0.0107562	0.007841	0.1701289		0.0170345	0.0057791	0.0032023	***
44	0.007436	0.0074944	0.3210959		0.0161729	0.0059294	0.0063798	***
45	0.0114524	0.0080233	0.1534685		0.016701	0.0057814	0.0038677	***
46	0.0114777	0.0077136	0.1367544		0.0173453	0.0059274	0.0034302	***
47	0.0120447	0.0077413	0.1197314		0.0150518	0.0058859	0.0105506	**
48	0.0093252	0.0075401	0.2161812		0.0169717	0.0058809	0.0039028	***
49	0.010946	0.0076703	0.1535619		0.0173671	0.0059374	0.0034443	***
50	0.0093229	0.0077388	0.2283196		0.0170555	0.0058639	0.0036307	***
Average	0.0108643	0.007687	0.1672747		0.0168539	0.0058945	0.0050237	***

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A10. Simulation of the analysis after random exclusion of companies biased toward elimination of two times more companies endowed with high human capital than the ones with low human capital, based on approximated age-by-age survival rates from the EUROSTAT dataset; 50 iterations.

No.	Generic Human Capital			Specific Human Capital			
	Coefficient	St. Err.	p-value	Coefficient	St. Err.	p-value	
1	0.0054684	0.0077325	0.4794456	0.0131584	0.0060211	0.0288617	**
2	0.0067811	0.007439	0.3620046	0.0131428	0.0058714	0.0251924	**
3	0.0076238	0.0076941	0.3217528	0.0134803	0.0058268	0.0206943	**
4	0.0065389	0.0075129	0.3841089	0.0105264	0.0058451	0.0717208	*
5	0.0086808	0.0076575	0.256952	0.0148332	0.0060294	0.0138885	**
6	0.0037007	0.0078301	0.6364778	0.0123641	0.0060438	0.0407819	**
7	0.0050469	0.0077083	0.5126423	0.0116687	0.0058896	0.0475643	**
8	0.003582	0.0076036	0.6375773	0.0103909	0.0058543	0.0759116	*
9	0.0091725	0.0079242	0.2470544	0.0127007	0.005909	0.0316038	**
10	0.0070902	0.0078576	0.3668759	0.0114164	0.0060451	0.0589509	*
11	0.0114653	0.007745	0.1387791	0.0142794	0.0059339	0.0161106	**
12	0.0064034	0.007797	0.411499	0.0121422	0.0058406	0.0376226	**
13	0.007587	0.0076857	0.3235684	0.0113811	0.0058772	0.052809	*
14	0.0053117	0.0075779	0.4833408	0.0120755	0.0057709	0.0363965	**
15	0.005011	0.0077567	0.5182669	0.009591	0.0058488	0.1010457	
16	0.0051793	0.0076804	0.500088	0.0118645	0.0058782	0.0435498	**
17	0.0026722	0.007609	0.7254441	0.012057	0.0058966	0.0408797	**
18	0.0036863	0.0077323	0.633551	0.0120627	0.0057827	0.0369794	**
19	0.0067838	0.0075487	0.368827	0.0115883	0.0058252	0.0466613	**
20	0.0042649	0.007689	0.5791133	0.0120439	0.0058286	0.038795	**
21	0.0056468	0.0077735	0.4675864	0.0097974	0.0058544	0.0942233	*
22	0.0049289	0.0077315	0.5237883	0.011727	0.0058377	0.0445562	**
23	0.0068438	0.0073631	0.3526456	0.0104893	0.0058402	0.0724875	*
24	0.0045572	0.0078712	0.5626082	0.0100319	0.0058749	0.0877154	*
25	0.0066249	0.0075721	0.3816269	0.0115886	0.0059954	0.053245	*
26	0.006484	0.0078367	0.4080108	0.0102318	0.0058243	0.0789623	*
27	0.0060187	0.0076989	0.4343516	0.0121109	0.0058523	0.0385057	**
28	0.0029307	0.0075008	0.696008	0.0125012	0.0060387	0.0384363	**
29	0.0056538	0.0076367	0.4590862	0.0128253	0.0059159	0.0301627	**
30	0.0075753	0.0078533	0.3347437	0.012062	0.0057844	0.0370449	**
31	0.0050194	0.0076288	0.5105667	0.0098274	0.0058701	0.0941013	*
32	0.0079246	0.0074159	0.2852552	0.0128135	0.0057026	0.0246425	**
33	0.0081598	0.0079041	0.3019085	0.0122332	0.0058809	0.0375099	**
34	0.0062468	0.0075345	0.4070511	0.0136678	0.0058152	0.018756	**
35	0.0066786	0.0075403	0.3757691	0.0129903	0.0059056	0.0278317	**
36	0.0091364	0.0076831	0.2343772	0.0132582	0.0058174	0.0226647	**
37	0.0029848	0.0076887	0.6978616	0.012254	0.0059299	0.0387821	**
38	0.0042921	0.0075217	0.5682491	0.013673	0.0059025	0.0205326	**
39	0.0069913	0.0077322	0.3659028	0.0108115	0.0058245	0.0634218	*
40	0.0050615	0.0075359	0.5018052	0.0109113	0.0057075	0.0559076	*
41	0.0053986	0.0073261	0.4611818	0.0131712	0.0057217	0.0213374	**
42	0.003414	0.0075978	0.653183	0.012472	0.0058113	0.031859	**
43	0.00882	0.0075974	0.2456722	0.0139307	0.0059225	0.0186649	**
44	0.007315	0.0076169	0.3368753	0.0138855	0.0058177	0.0169971	**
45	0.0083927	0.0077281	0.2774771	0.0140593	0.0058482	0.0162161	**
46	0.0061754	0.0075034	0.4105008	0.0134483	0.0058369	0.0212207	**
47	0.0045116	0.0075996	0.552735	0.0123003	0.005957	0.0389358	**
48	0.0047496	0.0075131	0.5272743	0.0108638	0.0058523	0.0634076	*
49	0.0032417	0.0074695	0.6642942	0.0108335	0.005792	0.0614261	*
50	0.007884	0.0078121	0.3128757	0.0120415	0.0059187	0.0419013	**
Average	0.0060342	0.0076514	0.4439728	0.0121116	0.0058694	0.0435495	**

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A11. Two-stage logit and pooled logit models based on Inverse Mills ratio estimated from the RITA dataset.

Analysis type **Model** **Dep. variable**	**Logit** **(A11a)** ***Founded after reform***	**Pooled logit** **(A11b)** ***Foundation***
Generic human capital	0.012	−0.009
	(0.008)	(0.006)
	[0.127]	[0.133]
Specific human capital	0.017	−0.011
	(0.006)	(0.004)
	[0.004]	[0.013]
Post growth reform		1.748
		(0.139)
		[0.000]
Post growth reform		0.011
x Generic human capital		(0.007)
		[0.123]
Post growth reform		0.014
x Specific human capital		(0.005)
		[0.011]
International experience	−0.162	0.001
	(0.362)	(0.003)
	[0.654]	[0.892]
Gender male	−0.369	−0.002
	(0.164)	(0.001)
	[0.024]	[0.260]
Parent entrepreneur	−0.002	0.001
	(0.152)	(0.001)
	[0.987]	[0.209]
Founding team size	0.081	−0.001
	(0.052)	(0.001)
	[0.113]	[0.830]
GDP per capita		0.001
		(0.000)
		[0.000]
TEA	27.431	13.861
	(9.490)	(2.797)
	[0.004]	[0.000]
Inverse Mills ratio	0.213	0.002
	(0.854)	(0.005)
	[0.803]	[0.706]
Const.	−2.983	44.021
	(2.373)	(3.555)
	[0.209]	[0.000]
Industry dummies	Included	Included
Regional dummies	Included	Included
Observations	3420	28381
Founders	3420	4055
Companies	1497	1769
Log. likelihood	−1304.5147	−9512.397
Pseudo R^2 / Wald Chi^2	0.1195	0.1823

Notes: The reported standard errors (in parenthesis) are robust standard errors clustered by company. *p*-values are shown in the square brackets.

Table B1. Regression discontinuity analysis for different time windows.

Analysis type Model Dep. variable	Logit (B1a) *Founded after reform*	Logit (B1b) *Founded after reform*	Logit (B1c) *Founded after reform*	Logit (B1d) *Founded after reform*	Logit (B1e) *Founded after reform*
Generic human capital	0.103	0.003	0.001	0.009	0.008
	(0.028)	(0.027)	(0.015)	(0.009)	(0.008)
	[0.000]	[0.922]	[0.925]	[0.311]	[0.332]
Specific human capital	0.079	0.042	0.021	0.014	0.017
	(0.029)	(0.017)	(0.012)	(0.008)	(0.006)
	[0.008]	[0.013]	[0.079]	[0.082]	[0.005]
International experience	0.750	−0.512	−0.411	0.067	−0.066
	(0.507)	(0.395)	(0.219)	(0.145)	(0.121)
	[0.139]	[0.195]	[0.061]	[0.640]	[0.581]
Gender male	−0.846	0.201	−0.052	−0.134	−0.302
	(0.377)	(0.409)	(0.249)	(0.193)	(0.170)
	[0.025]	[0.623]	[0.835]	[0.485]	[0.076]
Parent entrepreneur	0.611	0.082	−0.075	0.241	0.092
	(0.465)	(0.458)	(0.262)	(0.182)	(0.156)
	[0.189]	[0.857]	[0.774]	[0.186]	[0.552]
Founding team size	−0.600	0.355	−0.111	0.027	0.039
	(0.276)	(0.257)	(0.099)	(0.070)	(0.057)
	[0.030]	[0.167]	[0.265]	[0.700]	[0.487]
TEA	−800.05	−122.11	−94.640	−1.143	18.941
	(284.82)	(36.975)	(16.829)	(7.807)	(6.970)
	[0.005]	[0.001]	[0.000]	[0.884]	[0.007]
Const.	−24.947	3.860	5.614	0.014	−2.037
	(9.507)	(1.483)	(1.942)	(1.987)	(2.157)
	[0.009]	[0.009]	[0.004]	[0.995]	[0.345]
Industry dummies	Included	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included	Included
Time window [months]	3	6	12	18	24
Observations	116	283	731	1400	2110
Log. likelihood	−10.7471	−102.5692	−328.3464	−740.5903	−1034.6319
Pseudo R^2 / Wald Chi^2	0.8662	0.4758	0.3295	0.1332	0.1177

Notes: The reported standard errors (in parenthesis) are robust standard errors clustered by company. *p*-values are shown in the square brackets.

Table C1. Robustness analysis of the baseline results based on a sample that excludes founders that founded firms in the period just before or just after the reform (6-month window).

Analysis type Model Dep. variable	Logit model (C1a) *Founded after reform*	Logit model (C1b) *Founded after growth reform*	OLS regression (C1c) *Total sales log*
Generic human capital	0.012	0.008	−0.032
	(0.010)	(0.007)	(0.018)
	[0.221]	[0.208]	[0.083]
Specific human capital	0.021	0.020	−0.018
	(0.007)	(0.005)	(0.010)
	[0.003]	[0.000]	[0.072]
Post growth reform			−0.447
			(0.300)
			[0.136]
Post growth reform			0.028
x Generic human capital			(0.019)
			[0.155]
Post growth reform			0.025
x Specific human capital			(0.011)
			[0.023]
International experience	0.011	0.197	−0.273
	(0.140)	(0.109)	(0.091)
	[0.939]	[0.070]	[0.003]
Gender male	−0.293	−0.295	−0.071
	(0.186)	(0.131)	(0.118)
	[0.116]	[0.025]	[0.546]
Parent entrepreneur	−0.016	0.308	−0.094
	(0.194)	(0.134)	(0.135)
	[0.932]	[0.041]	[0.485]
Founding team size	0.110	0.169	−0.057
	(0.063)	(0.048)	(0.054)
	[0.081]	[0.000]	[0.297]
Age			0.818
			(0.081)
			[0.000]
Incubated			−0.307
			(0.169)
			[0.069]
TEA	87.483	50.099	1.842
	(16.650)	(9.166)	(3.848)
	[0.000]	[0.000]	[0.063]
Const.	−6.322	−5.210	0.802
	(2.748)	(1.742)	(1.310)
	[0.021]	[0.003]	[0.541]
Industry dummies	Included	Included	Included
Regional dummies	Included	Included	Included
Observations	2784	3286	2354
Founders	2784	3286	2354
Companies	1212	1422	1012
Log. likelihood	−852.423	−1582.521	/
(Pseudo) R^2	0.202	0.144	0.261

Notes: The robustness analyses were performed on the basic models only, for each hypothesis. The full set of models estimated on the sample that excluded founders who founded firms around the reform is available upon request. The number of observations varies between models due to the relatively fine-grained taxonomies of industries (NACE Rev. 2 intermediate aggregation) and regions (Nuts 2 level), which yields no variation in the dependent variables within some of the groups. The reported standard errors (in parenthesis) are robust standard errors clustered by company. p-values are shown in the square brackets.

Table C2. Robustness check of firm growth determinants based on an alternative measure (Percentage of R&D expenditures as a proxy of firm growth potential).

Analysis type	Tobit		Tobit	
Model	(C2a)	(C2b)	(C2c)	(C2d)
Dep. variable	*R&D expenditures*		*R&D expenditures*	
Human capital	−0.046		−0.171	
	(0.028)		(0.024)	
	[0.104]		[0.000]	
Generic human capital		0.146		−0.276
		(0.037)		(0.032)
		[0.000]		[0.391]
Specific human capital		−0.143		−0.254
		(0.028)		(0.026)
		[0.014]		[0.000]
Founded after growth reform	8.920	9.406	5.792	6.289
	(0.753)	(0.763)	(0.635)	(0.644)
	[0.000]	[0.000]	[0.000]	[0.000]
Founded after growth reform x Human capital	0.012		0.131	
	(0.028)		(0.024)	
	[0.671]		[0.000]	
Founded after growth reform x Generic human capital		−0.095		−0.012
		(0.039)		(0.034)
		[0.014]		[0.717]
Founded after growth reform x Specific human capital		0.077		0.206
		(0.028)		(0.027)
		[0.006]		[0.000]
International experience	1.930	2.082	3.614	3.703
	(0.394)	(0.395)	(0.335)	(0.339)
	[0.000]	[0.000]	[0.000]	[0.000]
Gender male	5.530	5.792	4.949	5.035
	(0.732)	(0.734)	(0.620)	(0.623)
	[0.000]	[0.000]	[0.000]	[0.000]
Parent entrepreneur	1.240	1.124	2.829	2.707
	(0.509)	(0.513)	(0.445)	(0.450)
	[0.015]	[0.028]	[0.000]	[0.000]
Founding team size	−0.384	−0.409	−0.382	−0.411
	(0.154)	(0.155)	(0.171)	(0.173)
	[0.013]	[0.008]	[0.026]	[0.017]
Age	2.926	2.947	2.487	2.484
	(0.257)	(0.258)	(0.211)	(0.212)
	[0.000]	[0.000]	[0.000]	[0.000]
Incubated	2.833	2.872	2.564	2.560
	(0.570)	(0.572)	(0.462)	(0.464)
	[0.000]	[0.000]	[0.000]	[0.000]
TEA	−31.958	−30.539	1.537	2.228
	(13.830)	(13.886)	(11.483)	(11.538)
	[0.021]	[0.028]	[0.893]	[0.847]
Const.	−252.698	−254.625	−246.772	−247.189
	(0.812)	(0.816)	(0.677)	(0.682)
	[0.000]	[0.000]	[0.000]	[0.000]
Industry dummies	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included
Observations	3963	3963	1735	1735
Companies	1735	1735	1735	1735
Log. likelihood	−16023.069	−16019.965	−7018.514	−7017.940
Pseudo R^2	0.0100	0.0102	0.0098	0.0098

Notes: Models **C2**a-d are estimated using a Tobit regression due to the nature of the dependent variable (percentage of R&D expenditures out of total sales). Models **C2**a and **C2**b are based on a sample of founders, while models **C2**c and **C2**d are based on a sample of companies. The reported standard errors (in parenthesis) are robust standard errors clustered by company. *p*-values are shown in the square brackets.

Table D1. Additional evidence on specific human capital that is broken down into specific work experience and entrepreneurial experience.

Analysis type	**Logit**
Model	**(D1)**
Dep. variable	***Founded after reform***
Generic human capital	0.012
	(0.007)
	[0.109]
Specific work experience	0.014
	(0.006)
	[0.019]
Entrepreneurial experience	0.030
	(0.010)
	[0.004]
International experience	−0.080
	(0.110)
	[0.467]
Gender male	−0.385
	(0.160)
	[0.016]
Parent entrepreneur	−0.014
	(0.152)
	[0.927]
Founding team size	0.089
	(0.047)
	[0.057]
TEA	27.483
	(9.445)
	[0.004]
Const.	−2.281
	(2.251)
	[0.208]
Industry dummies	Included
Regional dummies	Included
Observations	3420
Founders	3420
Companies	1497
Log. likelihood	−1309.5256
Pseudo R^2 / Wald Chi^2	0.1161

Notes: The reported standard errors (in parenthesis) are robust standard errors clustered by company. *p*-values are shown in the square brackets.

Table D2. Additional evidence on growth reform impact that is broken down into funding instruments and employee human capital instruments.

Analysis type **Model** **Dep. variable**	**Logit** **(D2a)** ***Founded after growth reform – funding***	**Logit** **(D2b)** ***Founded after growth reform – human capital***
Generic human capital	0.001	0.006
	(0.005)	(0.005)
	[0.907]	[0.240]
Specific human capital	0.010	0.008
	(0.004)	(0.004)
	[0.024]	[0.041]
International experience	0.068	0.074
	(0.083)	(0.080)
	[0.413]	[0.357]
Gender male	−0.221	−0.140
	(0.105)	(0.101)
	[0.036]	[0.167]
Parent entrepreneur	0.238	0.176
	(0.103)	(0.099)
	[0.021]	[0.076]
Founding team size	0.067	0.079
	(0.045)	(0.035)
	[0.113]	[0.025]
TEA	7.534	9.349
	(3.356)	(4.931)
	[0.160]	[0.058]
Const.	−0.177	2.122
	(1.532)	(1.982)
	[0.908]	[0.285]
Industry dummies	Included	Included
Regional dummies	Included	Included
Observations	3890	3953
Founders	3890	3953
Companies	1689	1724
Log. likelihood	−2356.4992	−2495.0563
Pseudo R^2 / Wald Chi^2	0.0929	0.0806

Notes: The reported standard errors (in parenthesis) are robust standard errors clustered by company. *p*-values are shown in the square brackets.

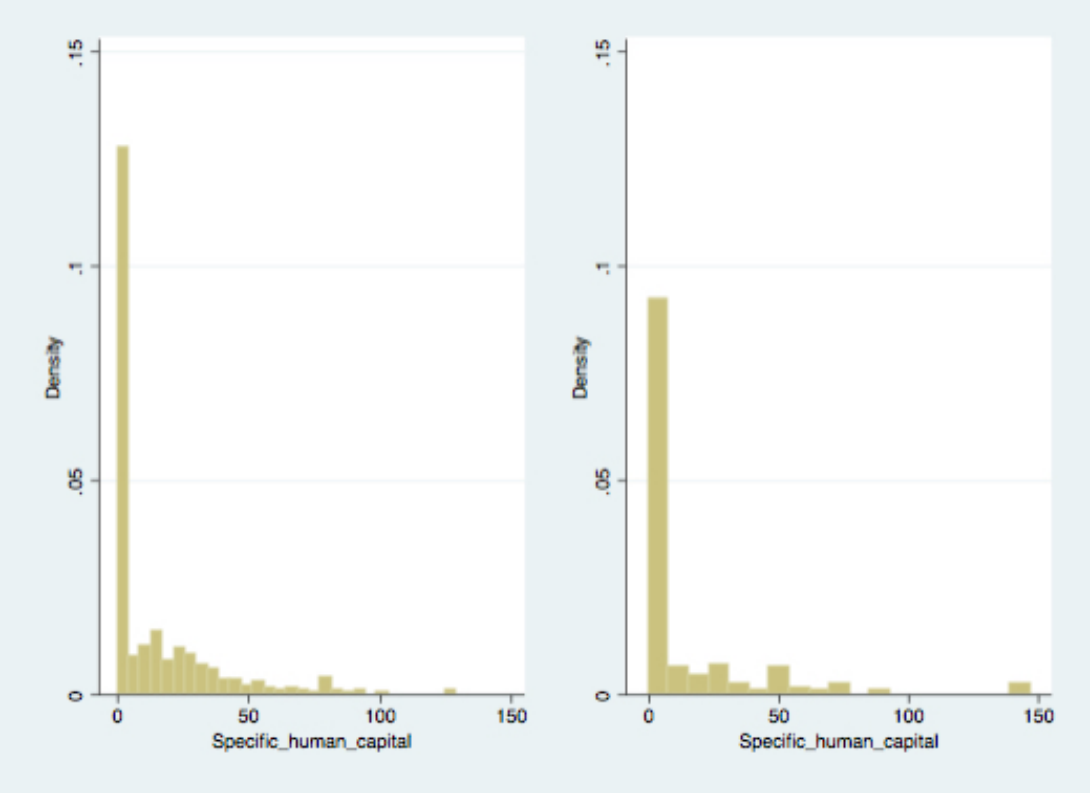


Figure A1. Distribution of specific human capital endowments of non-failed (left hand side) and failed (right hand side) firms in the RITA dataset.

Paper B. We're Hiring! Entrepreneur Characteristics and Talent Sorting in Innovative Startups

Abstract

As extensively reiterated in the existing literature, entrepreneurs' human capital is crucial for new venture survival and growth. However, little is known about what makes startups more attractive for high quality employees. Drawing upon the resource-based view, this paper analyses the relationship between founders' characteristics and the presence of non-founding employees. We examine this link based on a unique dataset of Italian innovative startups built form a survey administered in 2016. First, we find that entrepreneurial teams endowed with greater human capital – in particular prior entrepreneurial experience – are more likely to attract talent in early stages, especially in more innovative firms. Second, founding motivations matter. Necessity-driven entrepreneurs are less likely to have non-founding employees, regardless the technology intensity of their business. Finally, the results confirm the existence of a positive sorting between entrepreneurs and employees in terms of talent: more experienced and skilled entrepreneurs are more likely to be matched with more talented "joiners", while the opposite is true for necessity-driven entrepreneurs. We discuss implications for research as well as policy makers concerned with the role of entrepreneurs' human capital in the hiring process.

Keywords: Entrepreneurship; Human capital; Innovative startups; New venture hiring; Resource-Based View

JEL Codes: L26; M13; M51

1. Introduction

It is generally recognized in the existing literature that startups are important drivers of innovation and economic growth (Van Praag and Versloot, 2007). In particular, entrepreneurial activity in high-tech sectors has been shown to contribute to exploit R&D activities, improve competition, and boost both economic growth and job creation (e.g., Audretsch et al., 2006; Carree and Thurik, 2010). While earlier literature suggests a key role of entrepreneurial activity for economic and social development, these positive impacts are most often attributed to growth-oriented startups. As a consequence, scholars have for long time aimed at identifying the micro-level determinants of opportunity discovery and exploitation, and ultimately new venture performance, with a particular emphasis on founders' characteristics, namely their human capital, as a point of departure (e.g., Cooper et al., 1994; Gimeno et al., 1997). The value of founders' education attainment (Colombo and Grilli, 2005), industry (Ardichivili et al., 2003; Shane, 2000), work, and entrepreneurial experience (Delmar and Shane, 2006), as well as personal traits, such as ambition and risk propensity, have been significantly associated to new venture performance (DeTienne and Chandler, 2007; Foo, 2011; Lévesque and Minniti, 2011; Van Praag and Cramer, 2001).

However, innovative entrepreneurs can hardly guarantee success on their own, being highly reliant on their employees too (Coad et al., 2017; Honorè and Ganco, 2016). In this perspective, the scientific community is paying increasing attention to startup employees as key entrepreneurial actors contributing to performance too (e.g., Agarwal et al., 2016; Koch et al., 2013; Rocha et al., 2018, Siepel et al., 2017). The most recent debate has thus shifted the focus to *joiners* (i.e. employees who decide to join an early stage startup instead of a large established firm), identifying them as a distinct group in entrepreneurial contexts (e.g., Honorè and Ganco, 2016), with a different set of characteristics and preferences (Roach and Sauermann, 2015).

Surely not surprisingly, the awareness that employees matter for startup performance is not entirely new. Shane (2003) and Cardon and Stevens (2004), for instance, had demonstrated earlier that hiring

additional individuals provides access to more resources and competences, thereby improving a broad number of performance indicators such as survival, growth, and profitability. Despite the acknowledged importance of human resources for entrepreneurial success, attracting employees is quite challenging for early stage firms, given their liabilities of newness (Freeman et al., 1983; Stinchcombe, 1965) and smallness (Aldrich and Auster, 1986), their consequent lack of company legitimacy (van Werven, 2015), their well-established disadvantages relative to large incumbent companies in terms of financial resources, which all plague their ability to offer competitive wages and work conditions (Cardon and Stevens, 2004; Williamson et al., 2002). For these reasons, large established firms and new small ventures are likely to differ in their recruitment practices and in the overall quality of employees they manage to attract (Cardon and Tarique, 2008; Carroll et al., 1999).

Given these findings, it becomes crucial to understand how startups can mitigate these limitations and succeed in hiring. Since founders are the first architects of the ventures they establish, we posit that hiring success is tightly tied to their own characteristics, such as their experience and motivations. Yet, in-depth empirical evidence on the role of founders in the selection of non-founding employees is still missing in the literature (see Bublitz et al., 2017; Coad et al., 2017; Honorè and Ganco, 2016; Rocha et al., 2018 for valuable exceptions). This gap is even more striking in face of the richness of scientific evidence on how founder characteristics matter for the formation of entrepreneurial teams and attraction of co-founders (e.g., Clarysse and Moray, 2004; Forbes et al., 2006; Ruef et al., 2003).

This study contributes to reduce this gap by first examining the relationship between both founders' human capital – in particular their previous entrepreneurial experience – and motivations and the presence of non-founding employees in the venture. Second, we add a new layer of complexity to the analysis by investigating whether and how the innovation intensity in the firm moderates these relationships. Finally, we contribute to the recent discussion on human capital sorting in startup settings (see for instance Honorè and Ganco, 2016; Rocha et al., 2018) by studying the relationship between both founders' characteristics and the average quality of non-founding employees in the

venture, while accounting for possible self-selection bias in the decision to hire human resources beyond the founding members.

We test our theoretical hypotheses with a representative sample of 1,696 innovative startups, surveyed in 2016 by the Italian government. The dataset provides a detailed snapshot of each founding team member and each non-founding employee in the firm by the time of the survey. Thanks to the detailed information on individual characteristics and human capital dimensions of both groups, we are able to provide a relatively detailed description of the complex dynamics involved in attracting talent to young innovative companies. Nevertheless, given the cross-sectional nature of our data, we do not claim causality in any of the relationships we theorize and test.

We find that entrepreneurs with greater entrepreneurial experience are more prone to hire non-founding employees. This relationship is amplified in more innovative startups, suggesting that both the quality of the entrepreneurs and the context where they operate are important drivers of heterogeneity in hiring, which might have further implications on the growth prospects of new firms and, consequently, their economic and societal impact. Additionally, conditional on hiring, we find a positive assortative matching between entrepreneurial teams and non-founding employees in terms of their human capital characteristics. In particular, founding members with greater entrepreneurial experience endowments match with employees with higher levels of education, experience, and skill coherence with the job they are assigned to. On the other hand, necessity-driven entrepreneurs are found to match with less skilled employees on average, which is in line with recent studies demonstrating their preference for cost leadership strategies instead of differentiation strategies (Block et al., 2015).

The paper is structured as follows. Next section develops the theoretical background on the role of entrepreneurs' human capital and motivations in hiring outcomes, namely talent attraction and talent sorting. Then, we describe the empirical setting and methods used to test our theoretical hypotheses.

The subsequent section presents and discusses the empirical results, and the last section concludes and derives some key implications for research and practice.

2. Hiring Non-Founding Employees in Startups: Theory and Hypotheses

2.1 Background

There is a remarkable body of research echoing the role of entrepreneurial human capital as a key driver of success – measured by survival, growth, or securing venture capital funding – in newly founded technology-based firms (e.g., Aspelund et al., 2005; Colombo and Grilli, 2005, 2010; Ganotakis, 2012; Hsu et al., 2007). Based on the resource-based view of the firm, resources and capabilities are regarded as the principal sources of sustainable competitive advantage (Argote et al., 2003; Eisenhardt and Martin, 2000; Grant, 1996; Helfat and Raubitschek, 2000; Henderson and Cockburn, 1994; Iansiti and Clark, 1994; Klepper and Simons, 2000), and the hypothesis that firms established by individuals with greater human capital are more likely to survive and outperform other entrants has been largely confirmed by empirical studies in a variety of countries and sectors (Baum et al., 2000; Boyer and Blazy, 2014; Cassar, 2014; Colombo and Grilli, 2005; Gimeno et al., 1997; Kato et al., 2015).

Surprisingly, much less attention has been paid to those individuals who join founders in their entrepreneurial endeavours. Research explicitly acknowledging the value of non-founding employees has emerged only recently (Coad et al., 2017; Sauermann, 2017; Siepel at al., 2017), but the literature remains relatively silent on the antecedents of talent attraction in new firms. Yet, latest studies reiterate the need for further investigation, by revealing interdependencies between founders' and non-founding employees' characteristics (e.g., Siepel et al., 2017; Rocha et al., 2018).

This research gap is exacerbated in the context of young innovative companies, whose survival chances and long-term performance might be particularly reliant on early human capital endowments (Andries and Czarnitzki, 2014; Sommer et al., 2017; Wright et al., 2001). In particular, technology-

intensive startups need to attract additional human capital beyond that embodied in the founding team, which rarely includes the necessary breadth and depth in skills, in order to further build capabilities and capture value from their innovations (Helfat and Lieberman, 2002). The inability to obtain key complementary skills via hiring in the early stages of the new venture can thus become highly detrimental to survival and performance (Siepel et al., 2017).

Even though it is fundamental to attract people beyond founding members in order to grow, startups are distinct employers in many respects compared to established firms (Neff, 2012; Roach and Sauermann, 2015) due to the presence of severe entry barriers and a variety of quite persistent liabilities. New ventures face liabilities of newness (Freeman et al., 1983) and smallness (Aldrich and Auster, 1986), which in turn limit the assessment of their expected success by outsiders, and damage their legitimacy and distinctiveness (van Werven, 2015). Entrepreneurs have therefore a comparative disadvantage relative to established firms when trying to attract potential employees. Yet, entrepreneurs' characteristics, such as their human capital endowments and founding motivations, might moderate this disadvantage by shaping their ability to recruit employees, as we next theorize.

2.2 The role of founders' human capital in attracting non-founding employees

Startup hiring is the final realization of a complex two-sided matching process between entrepreneurs and potential joiners. From the supply-side, potential employees might be reluctant in joining startups due to the difficulty in judging the prospects of success of the new venture. First, assessing new ventures' potential is arduous since they operate generally under a high level of uncertainty and limited market distinctiveness (Moser et al., 2017). Second, having only short track records by which outsiders can assess firm quality further intensifies information asymmetries (Stuart et al., 1999). Third, new ventures are on average exposed to a greater failure rate than established firms (Deutsch and Ross, 2003; Rao et al., 2008), hence exposing employees to a considerable risk of losing their jobs (Ouimet and Zarutskie, 2014; Roach and Sauerman, 2017). Such job loss is not innocuous, since employment history in failed firms may adversely impact individual career reputation (Rider, Negro,

and Roberts, 2015). Lastly, the potential candidates' diffidence could be exacerbated in face of young and small ventures, which usually pay less than large, established firms (Burton et al., 2017; Haltiwanger et al., 2013). All these features create serious hiring obstacles for new ventures, by shrinking the pool of applicants that are potentially interested in a startup's job position (Cardon and Stevens, 2004).

Additional challenges plague the demand-side too. New ventures often lack adequate resources for human resource management (Cardon & Stevens, 2004; Katz and Welbourne, 2002), and therefore recruitment is often designed ad-hoc and conducted directly by the founding team (Katz and Welbourne, 2002). Moreover, especially in very early stages, founders lack both experience with the hiring process and financial resources to conduct broad labour market search to find the ideal matches (Coad et al., 2017), despite the pressure to attract human capital that can grant them and secure some competitive advantage, especially in knowledge-intensive industries (Barney, 1991).

Yet, we posit that certain founding teams might be better able than others to reduce these barriers to hire non-founding employees. Heterogeneities in their human capital endowments can both mitigate the challenges on the demand-side and provide signals, thereby reducing the information asymmetries that intensify supply-side constraints. First, according to the entrepreneurship human capital literature, high-skilled and experienced entrepreneurs are, on average, better at entrepreneurial judgment and at taking effective strategic decisions (Blume and Covin, 2011; Colombo and Grilli, 2005) – and hiring is certainly one of such decisions, especially in knowledge-intensive sectors and innovative ventures. Entrepreneurial leadership studies highlight how successful entrepreneurs are driven by leadership motivation, developing characteristics like vision, problem-solving, decision making and strategic initiative (Fernald et al., 2005). Consequently, experienced entrepreneurs are expected to have superior abilities to make joiners engaged in pursuing common goals.

Second, entrepreneurial teams with greater human capital endowments are also expected to better cope with potential coordination costs, team integration, and other transaction costs that make hiring such a risky process for an early stage startup, given the lack of any other formal human resource management procedure (Klaas et al., 2010) and the strong reliance on the entrepreneur(s) to architect all strategies.

Third, entrepreneurs' skills and experience might mitigate the potential employee candidates' reluctance to join the firm, by providing signals about the employer's commitment to the business – since they could potentially find equally, or better, paid and less risky outside options as paid employees – and, thus, the quality of the firm (Bublitz et al., 2017; Coad et al., 2017; Deutsch and Ross, 2003). Indeed, seminal studies largely confirm a positive association between entrepreneurial human capital and new venture survival rate (e.g., Brüderl et al., 1992; Gimeno et al., 1997), echoing the signalling power of those entrepreneurs' characteristics for outsiders. Additionally, entrepreneurial human capital is also likely to lessen financial constraints (Carpenter and Petersen, 2002) by being positively related to individual wealth (Xu, 1998) and furthermore raising the chances of succeeding in venture capital funding (Colombo and Grilli, 2010).

We follow a competence-based approach and reiterate the value of entrepreneurs' human capital as a distinctive factor in new ventures, with key implications for achieving success in hiring, by mitigating the several supply-side and demand-side obstacles described above. More formally, we hypothesize that:

Hypothesis 1: Greater endowments of human capital in the founding team is positively related to the presence of non-founding employees in the new venture.

2.3 The role of entrepreneurs' founding motivation in attracting non-founding employees

Not all firms arise from the identification of a market opportunity, and a considerable number of individuals decide to launch their own business to escape from deteriorating job conditions or even

job loss (e.g., Buenstorf, 2009). Entrepreneurs can therefore be highly heterogeneous in their motivations to found. Earlier studies have often categorized entrepreneurs in two broad categories: the so-called "necessity entrepreneurs", who tend to be pushed into new venture creation due to the lack of employment opportunities (Reynolds et al., 2005), and "opportunity entrepreneurship", which is an active choice to start a new firm based on the (sometimes subjective) perception that an attractive and unexploited business opportunity exists in the market (Acs and Varga, 2005; Baptista et al., 2014, Pia and Minniti, 2005; Reynolds et al. 2005).

However, it is generally believed that the most important ability of successful entrepreneurs is the capacity to identify, select, and exploit the right opportunities (Ardichvili et al., 2003; Stevenson et al., 1985). Consequently, necessity-driven entrepreneurs start out at a relative disadvantage compared to opportunity-based entrepreneurs, and might have troubles closing the performance gap, as suggested by their lower growth rates (e.g., Bruneel et al., 2013).

Founding motivations might also signal further heterogeneity in other entrepreneurial characteristics, such as social, financial, and human capital (Acs and Varga, 2005; Bergmann and Sternberg 2007; Block and Koellinger 2009; Block and Sandner 2009; Block and Wagner, 2010; Wong et al. 2005). As a consequence, the motivation to set up a business is likely to influence the strategy formation in the new venture, since entrepreneurs driven first and foremost by necessity are in a less favourable situation to plan the various startup activities (Block et al., 2015). This might have serious implications for their capacity to develop different products and/or services (Dencker et al., 2009) and to compete in more technology-intensive sectors (Williams, 2008). Moreover, opportunity costs are relatively lower for necessity driven entrepreneurs, who might therefore establish much lower performance thresholds in order to stay in entrepreneurship (Gimeno et al., 1997), which naturally reduces their growth ambitions. In this vein, Block et al. (2015) find evidence that necessity-based startups are more likely to depend on founders' family members, who are willing to work without remuneration in early

stages. For all these reasons, necessity motivations are expected to harm the likelihood of hiring non-founding employees compared to other startups driven by other motivations. More formally:

Hypothesis 2: Necessity-driven motivations to found are negatively related to the presence of non-founding employees in new ventures.

2.4 The moderating effect of new venture technology-intensity

The expenditures in Research & Development (R&D) activities are deemed to play a fundamental role in building the new venture's technological competencies, sustain comparative advantage, and thereby secure long-run profitability (Bogner et al., 1996; Zahra et al., 1999). This is particularly true for technology-based ventures, which work in a fast pace landscape and need resources to fund high-risk high-reward projects since the very early stage, in order to exploit a market opportunity and create some barriers for others to enter and compete (Baum and Silverman, 2004; Stevenson and Gumpert, 1985). Fast decision making is therefore key in more dynamic environments like technology-intensive sectors, since the ability to seize first mover advantages and reap their benefits is directly linked to the pace at which firms strategize and take action (Baum et al., 2000; Baum and Wally, 2003).

Empirical evidence shows that new ventures take faster decisions when they are run by individuals with prior entrepreneurial experience (Forbes, 2005). In addition, faster decision-makers can strengthen commitment from potential employees by signalling the proactive nature of the company and encourage employees to join and actively engage in the company's projects (Pfeffer and Sutton, 2000). The resource-based theory of the firm furthermore echoes how fundamental it is to acquire and retain human capital resources, in order to build and sustain competitive advantage (Colombo and Grilli, 2005) – and this urgency is even more pronounced in new ventures operating in high-tech industries. Accordingly, we expect the role of entrepreneurial human capital to be even more important for attracting additional talent in these settings. In other words, we posit that the R&D intensity of the firm positively moderates the relationship between entrepreneurial human capital and the presence of non-founding employees.

Hypothesis 3a. High-intensity R&D firms amplify the positive relationship between entrepreneurial human capital endowments and the presence of non-founding employees in the new venture.

Likewise, given the stronger need for more rigorous planning, faster decision making, and quick adaptation in technology-intensive environments, entrepreneurs triggered by necessity reasons are in more serious disadvantage compared to opportunity-driven entrepreneurs in these contexts (Block et al., 2015; Dencker et al., 2009; Williams, 2008). Business ideas that are dependent on considerable R&D investments require abundant resource endowments from the outset, and entering entrepreneurship while having unfavourable circumstances at the personal and/or career level might undermine success to a greater extent in such conditions (Wasserman, 2012).

On the contrary, entrepreneurs who are not driven by necessity reasons might be sparked by the identification of high potential business opportunities and, as suggested by Block et al. (2015), be more likely to pursue differentiation strategies to compete with incumbent firms. The success of technology-intensive ventures is, in turn, expected to depend on such opportunity identification and differentiation to a greater extent than other, less innovative, business settings, which reinforces the urgency in building capabilities and resources (Helfat and Lieberman, 2002). As a result, more R&D intensive ventures particularly require agility in attracting talent, which is likely to leave necessity-driven entrepreneurs in greater disadvantage relative to founders driven by other motivations. In other words:

Hypothesis 3b. High-intensity R&D firms amplify the negative relationship between necessity-driven motivations to found and the presence of non-founding employees in the new venture.

2.5 Assortative matching between entrepreneurs and non-founding employees

As reiterated above, hiring non-founding employees is crucial to guarantee new venture survival and growth (Koch et al., 2013; Sauermann, 2017), especially in knowledge-intensive environments (Klepper, 2001), but this entails great challenges for most entrepreneurs (Cardon & Stevens, 2004;

Katz and Welbourne, 2002). So far, we have established how entrepreneurial human capital and founding motivations alleviate or intensify the several barriers to hire. Attracting *high-quality* employees adds more complexity to this process.

The quality of jobs created by startups has been at the centre of an extensive policy discussion and rising academic interest (Burton et al., 2017; Litwin and Phan, 2013). While some findings suggest that high quality workers are, on average, matched with large established firms, thus leaving startups with a lower quality pool of candidates that they can tap into (Dahl and Klepper,2015; Ouimet and Zarutskie, 2014), other studies are more optimistic about the ability of young ventures to pay a wage premium (Burton et al., 2017; Dorner et al., 2017; Kim, 2018), which in turn would attract and reward higher quality employees.

We posit that new ventures' ability to attract high quality employees is strongly related to the quality of the entrepreneurial team (Aldrich and Ruef, 2006; Coad et al., 2017). More specifically, and building on recent studies demonstrating how entrepreneurs and their non-founding employees are matched in the labour market (Baptista et al., 2014; Honoré et al., 2016, Rocha et al., 2018), we expect a positive assortative matching in terms of their overall quality, captured by their human capital endowments.[1] In particular, we theorize that startups that are established by individuals endowed with greater human capital and driven by non-necessity reasons are more able to attract better human resources.

A variety of mechanisms sustain these theoretical hypotheses. First, both entrepreneurial skills and non-necessity motivations can work as strong signals of quality to reduce prospective employees' information asymmetries about how risky it might be to join the firm (Baptista et al., 2014; Siepel et al., 2017). Second, and likewise, both aspects can help entrepreneurs secure investors' support and the necessary funding to hire and target better candidates (Colombo and Grilli, 2010). Third, more skilled and experienced entrepreneurs possibly driven by the identification of an opportunity are more

[1] As defined by Carayol (2003) "An assortative matching process is said to be arising when best ranked agents (on a given criterion) preferentially match together (for our purpose collaborate)".

likely to take risks and be aware of what it takes to be successful and beat competitors, which involves making more ambitious investments in human capital acquisition (Ardichvili et al., 2003). We thus formulate our final hypotheses as follows:

Hypothesis 4a: There is a positive assortative matching between entrepreneurs and non-founding employees in terms of their human capital endowments.

Hypothesis 4b: Necessity-driven entrepreneurs tend to be matched with lower human capital employees than entrepreneurs driven by other non-necessity motivations.

3. Data and Methods

3.1 Empirical Setting and Sample

Estimating the associations between entrepreneurial team characteristics and the success in hiring non-founding employees requires detailed data on both entrepreneurs and their corresponding employees. For this purpose, we use the results of a survey conducted in Italy, between April and May 2016, by the National Committee of the Ministry for Economic Development, which includes, among other data, rich individual information for every employee and respective employers in a representative sample of Italian innovative startups. The process was managed by the Italian National Institute of Statistics (ISTAT) within the project "Monitoring and Evaluation of National policies for the Eco-system of Italian Innovative Startups". The main goal of the survey was to analyse the effect of a specific regulatory change: the law 221/2012, known as the "Italian Startup Act", implemented by the Italian Government in 2012 to spark innovative entrepreneurship in specific "Young Innovative Companies" (YICs). The targeted firms were innovative startups, formally defined as firms younger than 5 years, with a maximum of 5 million Euros in annual turnover, and not listed in the stock market. In addition, to be classified as "Innovative Startups", these firms cannot be incorporated from an M&A of existing companies (or from a divestiture of an existing company) or distribute dividends. Furthermore, the startup needs to fulfil at least one of the following three requirements: (i) the startup

(or its founders) should be in possession of tangible intellectual property rights, such as a patent or a license; (ii) the total expenditure in R&D should account for at least 15 % of total revenues; or (iii) at least one third of the people working for the startup (i.e. active shareholders and employees) must hold a PhD, or at least two thirds must have a Master degree.

This survey let us gather qualitative and quantitative data along a series of dimensions including R&D and innovation activities, firm growth, investments and, more interesting for this study, the human capital endowments of both entrepreneurs and employees. Specifically, as to these latter aspects, the first part of the questionnaire provides detailed information on demographic characteristics, type and level of education, previous work experience, coherence between the current job and individual skills, parents' previous occupation, and foreign experience of both the active shareholders and the employees. The final dataset is a detailed matched employer-employee cross-sectional snapshot of innovative startups in Italy, in which we base our analyses both at the firm-level (for the first part of the analysis on hiring events) and the employee-entrepreneurial team pair-level (for the second part of the analysis on the quality of employees).

The questionnaire was sent via email to all the Italian YICs listed in the aforementioned registry of young innovative startups, which was composed of 5,150 firms as of December 2015. The response rate was 44 percent, equal to 2,275 firms. We restrict our sample to firms with complete information about at least one of the active shareholders. Furthermore, we drop from our sample those startups that have declared to have employees but they did not provide any details about the employees' human capital. Our final sample contains 1,909 startups with non-missing information on the variables of interest. Chi-square tests show that there are no statistically significant differences between the distribution of our sample across geographic locations, industries, age, and legal status when compared to the full population of innovative startups in the registry.

3.2 Methods and Variables

3.2.1 Dependent variables and estimation methods

In order to test our Hypotheses 1 to 3, i.e. the relationship between entrepreneurial team's characteristics and the hiring decision, we have first computed an indicator variable, *Hiring*, which takes the value one if the firm reports at least one employee by the time of the survey, and zero otherwise.[2] Given the dichotomous nature of this dependent variable, we have tested the relationship between hiring non-founding employees and entrepreneurial team characteristics using the following probit model.

$$P(Hiring\ company_i = 1) = f_1(\boldsymbol{x_i\beta}) + \alpha\varepsilon_i, \quad (1)$$

where $\mathbf{x_i}$ is the vector of independent variables and all covariates as described in Table 1 and f_1 is the cumulative distribution function of the standard normal distribution.

Our final set of hypotheses (H4a and H4b) refer to the association between entrepreneurial characteristics and employees' quality. We conduct this part of the analysis at the employee-level, using different proxies for their quality. The first measure we use as an independent variable is a dichotomous variable, *Employee's education*, which is equal to one whenever the focal employee has obtained at least a M.Sc. degree (and zero otherwise). This measure is used as a proxy for more generic human capital endowments of the employee. Second, we use another binary variable, *Employee's Work Experience*, capturing whether the focal employee was active in the labour market (as paid employee, manager, or entrepreneur) right before joining the startup, or was instead unemployed or inactive (e.g. a student).[3] Finally, we use *Employee's Work-study coherence*, which takes the value one if the job position is considered coherent with the study path of the employee, and zero otherwise. The degree to which individuals' employment is aligned with their previous education may have

[2] As can be seen in Table 1, about 70% of all the firms in our sample have at least one employee. While the proportion seems quite high, we should note that our sample is composed of innovative startups. The statistics are in line with other similar datasets, such as the Kauffman Firm Survey, where almost 60% of the represented US startups over the period 2004/2011 have hired at least one employee.

[3] As a robustness check, we also use the employee's age as another proxy for their generic human capital.

relevant implications for startups' ability to benefit from their competencies. We use this measure as a proxy for the quality of the match between the employee skills and the job s/he is hired for, given that employees who get jobs that fit poorly with their competencies might feel dissatisfied and, therefore, be more likely to leave to other firms where they can find better matches. Employees whose occupation does not fit their previous educational investments are found to be more likely to look for other employment opportunities or even become entrepreneurs themselves (Stenard and Sauermann, 2016), while employees whose position fits well with their previous experience and training are more likely to be retained (Rosen, 1986). Employee turnover has crucial implications for startups, by indicating the loss of possibly valuable human capital and implying additional costs in attracting and training new employees (Campbell et al., 2012), so this final variable can also be a proxy for employee retention.

Obviously, variables pertaining to employees' quality are observed only for the startups hiring at least one employee beyond the founding team. It means that for about 30% of our sample (cf. Table 1) these dependent variables have missing information. Therefore, we cannot neglect potential issues of selection bias, given that startups with non-founding employees may be different in unobservable characteristics (e.g., better in the quality of the underlying business idea) than startups only composed of founders (see Grimpe and Kaiser, 2010 for another setting where sample selection might be a source of bias). Hence, we use a Heckman selection model (Heckman, 1977) in the second part of our analysis. The first stage model (selection equation) is basically the probit model estimated in (1) for the probability of hiring at least one employee, while the second stage refers to the human capital characteristics of each focal employee (different y_i variables), which are regressed on the same set of covariates as the first stage, except the variable *Parents Entrepreneurs*. This vector is therefore now denoted as $\boldsymbol{z_i}$ in equation (2), where f_2 refers to the linear function often used in the second stage of Heckman models:

$$y_i = f_2(z_i\Theta) + \lambda\varepsilon_i \quad (2)$$

To improve the identification in our selection model, we exclude the variable *Parents Entrepreneurs* from the second stage equation (see also Andries and Czarnitzki, 2014; Puhani, 2000). This variable assumes the value one if at least one founding member has been exposed to entrepreneurship through their parents (the mother, the father, or both), and zero otherwise. Having (at least one of the) parents in entrepreneurship can be a source of influence to engage in a similar career and facilitate the transition into the startup process (Davidsson and Honig, 2003). It is worth noting that entrepreneurial parents can also provide their offspring with a network that facilitates the discovery of opportunities, as well as the identification and collection of resources (Birley, 1985; Greene and Brown, 1997; Uzzi, 1999). For these reasons, having contact to entrepreneurship via parents' occupations is theoretically expected, and empirically demonstrated, to increase the propensity to hire employees. However, prior studies have not found robust evidence for a significant influence of parental entrepreneurship in their offsprings' performance as entrepreneurs (Davidsson and Honig, 2003; Sørensen, 2007), which also weakens any theoretical expectation of a significant association with the quality of the employees eventually hired. Interestingly, the pairwise correlation matrix (Table 2) confirms a weak correlation between *Parents Entrepreneurs* and the three measures of employee's quality (education, work experience, and work-study coherence). Likewise, the respective covariances are 0.009, 0.007, and 0.007, suggesting no strong correlations between employees' human capital and parental entrepreneurship among their employers, giving us confidence on using *Parents Entrepreneurs* as an exclusion restriction in our selection model. [4]

3.2.2 Explanatory variables

The explanatory variables defined to test our hypothesis refer to entrepreneurial human capital endowments and entrepreneurial motivations, based on previous entrepreneurship literature (e.g., Colombo et al., 2004; Gimeno et al., 1997). First, we have created the dummy variable *Entrepreneurial Experience*, which assumes the value one if at least one of the entrepreneurs have founded another

[4] The complete covariance matrix is available upon request.

startup before the focal venture under analysis. As highlighted in Table 1, 37% of the entrepreneurial teams included in our survey had an entrepreneurial experience before the current startup. Second, we have computed the variable *Managerial Experience*, a dummy equal to one if at least one of the members of the entrepreneurial team had a managerial position in the past, as another measure of specific human capital (see Colombo and Grilli, 2005), possibly different than entrepreneurial experience. Finally, we measure the education attainments of the founders through *High Education*, a dummy variable indicating whether at least one founding member has obtained at least a M.Sc. degree.

In order to capture the entrepreneurs' heterogeneous motivations (hypotheses 2 and 3b) to found the venture, we use the dummy variable *Necessity-driven motivations*, which distinguishes whether within the entrepreneurial team there is at least one member who had been pushed to establish the startup because s/he was "*in need to find an occupation*" according to the survey.

[Insert Table 1 around here]

Finally, we have computed the indicator variable *R&D investments*, equal to one if the startup has declared to have sustained some (formalized) R&D expenditure during its life. Startups with greater investments in R&D are expected to be more dependent on human capital, and thus be more likely to both hire and attract better quality employees on average. As highlighted in Section 2.4, more than estimating the association between this variable and the outcomes of interest, we want to test how it moderates the relationship between entrepreneurial team characteristics and hiring (hypotheses 3a and 3b). For this purpose, we have computed interaction terms between firm-level R&D intensity and entrepreneurs' (i) entrepreneurial experience (*Entrepreneurial experience x R&D investments*), (ii) education (*High Education x R&D investments*), (iii) managerial experience (*Entrepreneurial experience x R&D investments*), and (iv) necessity-driven motivations (*Necessity-driven motivation x R&D investments*).

3.2.3 Control Variables

Lastly, we have included in both regressions (i.e. the probit model for the hiring decision and the Heckman two-stage model for the quality of the employees) a set of control variables. We use the variable *Academic Experience Abroad*, which distinguishes entrepreneurial teams with at least one member who has (some) academic experience (e.g., a part of the academic degree, Erasmus project, or visiting Ph.D. student) in a foreign country. Moreover, we include the dummy variable *Work Experience Abroad*, which equals to one if within the founding team there are one or more individuals who had worked in foreign countries prior to establishing the startup. By having been abroad for a period – either while studying or working – entrepreneurs might have lost and weakened contacts in their home country, which might affect their ability to attract human resources. On the other hand, this experience might have also affected their capabilities and awareness of the importance of human capital for success, and instead boost their capacity to hire. Even though we cannot anticipate the sign of their coefficients, both variables are included in both parts of the analysis (the propensity to hire and the quality of the hired employees) to rule out any confounding explanations and possibly capture any unobserved heterogeneity among entrepreneurs in our sample.

In the same vein, we also control for the perceived entrepreneurs' work coherence within the founding team through the dummy variable *Work-study coherence*. If at least one founder considers that they have received adequate training for their current occupation, this variable takes the value one. This variable might represent a good match between entrepreneurs' skills and their occupational choice, while being possibly correlated with their unobserved ability, which might also have implications for both the probability of hiring and the quality of the employees attracted.

Additional controls include *Team Size* – the number of active shareholders in the startup – and *Institutions*, a dummy variable which takes the value one if there are any institutions (University, Research Centres, Public Institutions, and/or Venture Capitalists) in the shareholders' list. As highlighted in the existing literature (Baum and Silverman, 2004), the presence of institutional partners improves the likelihood of having a wider network of contacts, which can also increase the

chance to hire high skilled employees in early stages. We also add controls for *Firm Age* and for the presence of women in the entrepreneurial team (*Female Presence*), as both might have an influence in the hiring process and be correlated with the key variables of interest, i.e., both entrepreneurial human capital endowments and motivations to found. Finally, we control for geographic location at the NUTS3-level (*Regional dummy*), given that the hiring process may be strictly related to the availability of resources in the region. Table 2 reports the correlation matrix between the key variables. No multicollinearity issues are identified.

[Insert Table 2 around here]

4. Results

4.1 Hiring non-founding employees

Table 3 reports the results obtained from probit models predicting the probability of having non-founding employees in the startup. Model 1 is the baseline model testing the validity of Hypotheses 1 and 2. Table A1 in the Appendix reports the respective average marginal effects to make the interpretation of the coefficients easier.

[Insert Table 3 around here]

The coefficient of the variable *Entrepreneurial Experience* is positive and statistically significant, in line with Hypothesis 1. Based on the average marginal effects (Table A1), having at least one founding member with prior experience in entrepreneurship is estimated to increase the propensity to hire by about 7 percentage points compared to founding teams composed of novice, first time, entrepreneurs. This corresponds to a 10% increase in the average propensity to hire in our sample (cf. Table 1). On the other hand, *Managerial Experience* has a positive but not statistically significant coefficient, suggesting that these two variables capture different skills and types of human capital not necessarily equally relevant to attract employees.

With respect to the education level of the entrepreneurial team, we do not find a significant association between the variable *High Education* and the presence of non-founding employees in the firm. Actually, the coefficient is negative, against our prior expectations. However, one reasonable explanation for this lack of statistical significance might be the fact that most entrepreneurs in our sample have high levels of education (cf. Table 1), due to the criteria to be classified as an innovative startup (cf. Section 3). This might have reduced the variation in the educational level of entrepreneurs in our sample, and therefore we must interpret our estimates with caution and acknowledge a possibly limited ability to generalize our conclusions for this particular variable.

In summary, we find partial support for Hypothesis 1. Prior entrepreneurial experience seems to be a crucial endowment of human capital within entrepreneurial teams, which can help them reduce barriers to hire. Experienced entrepreneurs may instil a stronger confidence in the future success of the firm, greater legitimacy or commitment to the business, and thereby encourage others to join. This human capital might also give them the necessary knowledge or resources to grow via hiring. However, we cannot test which of these (or other) mechanisms explain the positive and significant link between entrepreneurial experience and the presence of non-founding employees in the firm.

Hypothesis 2 anticipated a negative association between necessity-driven motivations and the presence of non-founding employees in the venture. While the coefficient is negative, it is not statistically significant, rendering insufficient empirical support for Hypothesis 2 in our setting – where actually necessity-driven entrepreneurs are only a minority (about 10%). Lastly, more innovative startups are more prone to hire: the coefficient of *R&D Investments* is positive and statistically significant, and has the largest average marginal effect on the likelihood of observing non-founding employees in the startup by the time of the survey (an increase of 13 percentage points compared to less R&D intensity startups).

As regards the control variables, entrepreneurs with some academic experience in a foreign country were less likely to have employees by the time of the survey. Work experience abroad, in turn, seems

to be positively – though not significantly – related to hiring, suggesting that these types of experience might expose entrepreneurs to different learning environments and networks, and hence influence hiring differently. Having institutional partners (e.g., universities or VCs) is positively linked to the propensity to hire, as do entrepreneurial parents. Both might expose entrepreneurs to a greater network and thereby facilitate the hiring process in the early stages, in line with the social capital literature (e.g., Davidsson and Honig, 2003). Finally, as the firm matures, hiring becomes more likely, as expected.

In order to test the moderating effect of firm's *R&D investments* – Hypotheses 3a and 3b – we extend the baseline model with key interaction terms between this variable and both entrepreneurial human capital and motivations (Models 2 to 5). In Model 2, we find that the positive relationship between founders' entrepreneurial experience and hiring is stronger in firms with greater R&D investments. Actually, in relatively less R&D intensive firms, prior entrepreneurial experience turns out to be statistically negligible for the firm's propensity to hire. Figure 1 illustrates the associated marginal effects, confirming that entrepreneurial experience is a particularly relevant factor to attract human resources in more dynamic and innovative environments characterized by greater investments in R&D at the firm-level. Turning to the other founders' human capital characteristics, we do not find any significant interaction effect between entrepreneurial education attainment (Model 3), or managerial experience (Model 4), and firm technological intensity. Overall, these results reiterate the importance of entrepreneurial experience for talent attraction in high-innovative settings, providing partial support for Hypothesis 3a.

Finally, Model 5 tests the validity of Hypothesis 3b by adding the interaction term between *Necessity-driven Motivations* and *R&D Investments*. Although we find a negative and statistically significant coefficient for this interaction term, we cannot interpret it directly since the estimated model is non-linear. We therefore calculate the respective marginal effects, which are illustrated in Figure 2. We observe that necessity-driven entrepreneurs actually do not exhibit different hiring propensities

depending on the technology intensity of the firm. On the contrary, we find a remarkable difference among non-necessity driven entrepreneurs running more-innovative firms, who are significantly more likely to hire than other non-necessity entrepreneurs in less R&D-intensive startups. As previously discussed, the ability to successfully pursue a differentiation strategy is more likely to depend on the human capital of non-founding employees as the technology-intensity of the business increases. In addition, thanks to general better social, financial, and human capital starting conditions (Acs and Varga, 2005; Bergman and Stemberg, 2007), non-necessity entrepreneurs are probably better able to attract crucial competencies in fast-paced settings.

On the other hand, necessity-driven entrepreneurs, by not being first and foremost motivated by the identification of a business opportunity but rather by the lack of an alternative occupation, might not be sensitive to the technology-intensity of their business when making hiring decisions. This might have highly detrimental implications for their future performance – which we cannot test with the current data, but is worth investigating in future research. In conclusion, while we do not find a greater relative disadvantage of necessity-driven entrepreneurs in more technology-intensive environments when it comes to hiring (or retaining) talent, as advanced by Hypothesis 3b,

[Insert Figures 1 and 2 around here]

4.2 Positive assortative matching between entrepreneurial teams and non-founding employees

Table 4 reports our final tests for the validity of Hypotheses 4a and 4b. As described before, these estimations account for possible selection bias in the sample of firms hiring at least one employee, since the outcome variables can only be observed for firms with non-founding employees in their team by the time of the survey. We focus our attention on the second stage of our Heckman model, and use different measures of worker quality as dependent variables, to test the robustness of our results.

Model 1 relates the educational attainment of the focal employee (*Employee's Education*) to the characteristics of the entrepreneurial team. We confirm that the likelihood of hiring employees with

a higher education level is increased by the presence of highly educated individuals in the entrepreneurial team, since the coefficient of the variable *High Education* is positive and statistically significant at the 1% level, as advanced by H4a. However, we do not find any significant association between *Entrepreneurial Experienc*e, nor previous *Managerial Experience*, and the education level of the employees hired. Regarding the difference between opportunity and necessity entrepreneurs, we confirm that the latter are less likely to attract highly educated employees, as proposed by H4b. Given the higher average cost of better educated human resources, the lower propensity to have highly-educated employees in necessity-driven entrepreneurs' firms might be also interpreted as evidence of a preference for cost leadership approaches instead of differentiation strategies (Block et al., 2015).

Model 2 replicates the same analysis but uses employee's work experience as a dependent variable in the second stage, which indicates whether the focal employee was previously active in the labour market (as employed or self-employed). Our assumption is that these employees, everything else being equal, might be of better quality than individuals who were previously unemployed or out of the labour market (e.g., students), or at least that they bring with them possibly valuable knowledge and experience that might benefit the new venture hiring them. We find a positive and very strong association between this measure and entrepreneurial experience, as well as entrepreneurs' *Managerial Experience*, which suggests that entrepreneurs might leverage their previous work experience and skills in entrepreneurship and management roles to attract relatively more experienced individuals. These particular human capital dimensions of the entrepreneurial team might actually encourage potential candidates to leave their current firm and join a new venture, if they see potential in the idea owing to the experience accumulated by their founders. These results speak in favour of a positive matching between employees with more work experience with entrepreneurial teams with the same characteristics.[5] On the other hand, we do not find founders'

[5] We find very similar results when using employee's age as a dependent variable (model 4), confirming the positive assortative matching between employees and entrepreneurs in terms of experience.

education, nor motivations, to be significant factors for this particular dimension of employee human capital.

Model 3 uses as a dependent variable the coherence between the employee's educational training and the job s/he is assigned to in the current startup. We use this measure as a proxy for the quality of the fit between the employee and the job, which is expected to improve the employee's retention in, and satisfaction with, the firm. We find entrepreneurial teams with higher educational achievements to be more likely to attract better fits for their firms, which indicates that high level of education might allow entrepreneurs to better screen the labour pools and identify good matches. Simultaneously, a better educated founding team might encourage potentially good candidates in the market to take the risk and join the startup. On the other hand, necessity-driven entrepreneurs seem to be less able to find the right person for the right job compared to entrepreneurs motivated by other reasons. This finding aligns once again with the assumption that necessity-driven entrepreneurs are less likely to pursue long-term differentiation strategies, which require building specific competencies and retaining essential resources. Hiring and retaining good matches are certainly one example of such resources, especially in young innovative firms.

All in all, these results tend to confirm the existence of a positive sorting between entrepreneurs and employees: better educated entrepreneurs are more likely to be matched with better educated employees (and with employees whose skills fit the job they are assigned to), and more experienced entrepreneurs are more likely to be matched with more experienced employees, as theorized in H4a. Furthermore, as a secondary conclusion, our results indicate that it might be preferable to have somehow diverse entrepreneurial team members with different – and complementary – human capital dimensions, not just for their potential contribution for entrepreneurial success (Smith et al., 2005), but also because these teams seem to have more chances to attract employees with different complementary skills (i.e., high education and experience), which is believed to be at the heart of new venture performance (De Winne and Sels, 2010). Additionally, entrepreneurial teams who found their

ventures out of necessity seem to be in a disadvantaged position and often end up matched with employees of relatively lower human capital, as posited by H4b. In conclusion, we find a general support for our theoretical hypotheses with some nuances, depending on the measures used for employee quality and entrepreneurs' human capital.

As for the other variables included in these models, we generally find a positive and statistically significant association between firm R&D Intensity and the several measures of employee quality. This finding corroborates the importance of firm innovativeness in the talent attraction of potential employees (Sommer et al., 2017), given the general premise that innovative firms' long-term success is dependent on their access to key skills in early stages (Dahl and Keppler, 2015). Furthermore, and in line with our earlier reasoning, the results hint that entrepreneurs with some academic experience abroad might also get better access to highly educated, though less experienced, employees. Having legitimate institutions as partners is found to be positively and significantly linked with both employees' education and experience. These associations echo the value found earlier in institutions, such as VCs (Hellman and Puri, 2000), universities (Bonardo et al., 2011) and other institutional partners as sources of legitimacy that might help entrepreneurs attract high quality resources, such as joiners, by providing a credible signal to the labour market about the quality of the startup. Along with this line of reasoning, we also find that as firms mature, they also increase their propensity to hire more skilled and experienced employees, since surviving the critical initial periods gives more credibility to the business idea and additional signals about the chances of surviving further.

[Insert Table 4 around here]

5. Discussion and conclusions

As extensively reiterated by resource-based theory, human capital is crucial for new venture survival and growth. However, little is known about what makes startups more or less able to attract human resources – and especially high quality human resources. Recent studies have started looking for firm-level antecedents in the hiring process (Siepel et al., 2017) and whether small new ventures can also attract skilled employees (Dahl and Klepper, 2015; Sauermann, 2017; Sommer et al., 2017). We contribute to this debate by analysing the relationship between human capital characteristics of the entrepreneurial team and their hiring success. Our analysis is based on a unique and detailed dataset of Italian innovative startups, which was collected through a survey administered by the Italian National Institute of Statistics in 2016.

We theorize and show that entrepreneurial teams endowed with greater prior entrepreneurial experience – are more likely to hire in early stages, especially in more dynamic contexts characterized by higher investments in R&D. We fail to find similar support for two other dimensions of entrepreneurs' human capital though (managerial experience and education level). However, we find all entrepreneurial human capital measures to be somehow related to the talent eventually attracted to the startup, in the form of either more educated or more experienced employees. We therefore provide a more nuanced view of the resourced based-perspective in entrepreneurial settings. In particular, we build on extensive contributions highlighting the importance of entrepreneurial human capital for startup success (e.g., Cassar, 2014; Colombo and Grilli, 2005; Cooper et al., 1994) by investigating a specific channel through which entrepreneurs can achieve high performance: by attracting and retaining the best talented joiners in a timely manner. Even though a widespread literature refers to the need of securing human resources especially in innovative contexts (Klaas et al., 2010), entrepreneurship scholarship has been relatively more silent about *how* can these resources be acquired and what is the role of entrepreneurs' heterogeneity in skills and experience in this process. Furthermore, we complement this analysis by also considering the role of entrepreneurs'

motivations to found, demonstrating that necessity triggers can propagate entrepreneurs' disadvantages relative to their opportunity-driven counterparts by damaging their ability to attract talent.

These results have important implications for our theoretical understanding of the hiring decision in the entrepreneurial context. In particular, hiring is a two-sided matching process driven by demand- and supply-side forces that need to be aligned in order to make talent acquisition a successful endeavour for startups. Yet, it seems that a great deal of this success is dependent on the entrepreneur, or the entrepreneurial team, and specifically on their characteristics and how these characteristics can provide reliable signals to candidates about the quality of the firm. We also add another layer to this already complex process by addressing the moderating role of certain contexts, namely the moderating effect of R&D intensity in startups. The intersection between entrepreneurship and human capital theories should be ready to embrace contextual differences (at the firm- or other levels) more often, in order to enrich our understanding of the boundary conditions possibly limiting or amplifying the role of individual entrepreneurs in startup hiring strategies.

Our results have also important practical – and even policy – implications. First, as highlighted by other studies (e.g., Siepel e al., 2017), our findings resonate with recent policy efforts aiming at promoting new venture creation among experienced and highly skilled individuals, who are often believed to have better survival and growth chances (Ardichvili et al., 2003). By looking at how entrepreneurs' human capital might contribute to their success in hiring, we highlight a channel through which entrepreneurial human capital might guarantee new venture performance. On the one hand, their specific experience as entrepreneurs, namely prior startup experience, is a much stronger antecedent of hiring in the very first place, besides contributing to hiring relatively more experienced employees. On the other hand, we find a rather limited influence of other entrepreneurs' human capital dimensions in this process. It might be therefore worth reflecting on how business schools and universities can better prepare their students for an entrepreneurial career, since not all types of

human capital are equally important. Second – and still related to this – our findings have further implications for the formation of entrepreneurial teams. We find suggestive evidence of complementarities between different measures of human capital, since a combination of founders with specific entrepreneurial experience and founders with high education attainment might help startups overcome different challenges in the hiring process.

Our analysis is not without limitations. First, we acknowledge that our context might somehow limit the external validity of our study. Italy suffers a technology gap compared to countries like the US, so the startups, entrepreneurs, and employees composing our sample might be quite different than in other settings. We therefore encourage further research on these topics with data from different countries and industries. Second, we also acknowledge some data limitations. Unfortunately, we do not have any information about employees' wages or reliable firm performance measures before or after the (first) hiring event. Furthermore, we are relying on a cross-section, so we are unable to claim any causal relationships. Yet, we hope to have paved the road and encourage more research on startup hiring using different data and methods.

TABLES

Table 1 Descriptive statistics

	Mean	SD	MIN	MAX
Dependent Variables				
Hiring decision – Equation (1)				
Hiring	0.702	0.458	0.000	1.000
Employee's Human Capital – Equation (2)				
Employee's Education	0.496	0.500	0.000	1.000
Employee's Work Experience	0.397	0.489	0.000	1.000
Employee's Work-Study Coherence	0.786	0.410	0.000	1.000
Employee's Age	36.317	8.512	20.000	78.000
Covariates				
Entrepreneurial Experience	0.365	0.482	0.000	1.000
High Education	0.746	0.436	0.000	1.000
Managerial Experience	0.291	0.454	0.000	1.000
Necessity-driven Motivations	0.105	0.306	0.000	1.000
R&D Investments	0.824	0.380	0.000	1.000
Academic Experience Abroad	0.347	0.476	0.000	1.000
Work Experience Abroad	0.549	0.498	0.000	1.000
Work-Study Coherence	0.882	0.323	0.000	1.000
Institutions	0.593	0.491	0.000	1.000
Parents Entrepreneurs	0.288	0.453	0.000	1.000
Team Size	2.329	1.451	1.000	10.000
Firm Age	3.478	1.348	0.000	7.000
Female Presence	0.298	0.457	0.000	1.000

Table 2 Correlation matrix (with * p < .05. All two-tailed tests)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Entrepreneurial Experience	1.000																
(2) High Eeducation	-0.047*	1.000*															
(3) Managerial Experience	-0.160*	0.163*	1.000														
(4) Necessity-driven Motivations	-0.103*	0.050*	-0.010	1.000													
(5) R&D Investments	0.069*	0.042*	0.042*	-0.103*	1.000												
(6) Academic Experience Abroad	-0.058*	0.260*	0.142*	0.076*	0.070*	1.000											
(7) Work Experience Abroad	0.064*	0.079*	0.134*	0.005	0.083*	0.066*	1.000										
(8) Work-study Coherence	-0.017	0.292	0.090*	0.017	0.078*	0.109*	0.025	1.000									
(9) Institutions	0.078*	0.023	0.022	-0.009	0.094*	-0.005	0.059*	0.038*	1.000								
(10) Parents ntrepreneurs	0.067*	0.033*	0.050*	0.017	0.019	0.054*	-0.012	0.019	0.041*	1.000							
(11) Team Size	0.129*	0.240*	0.122*	0.176*	0.003	0.214*	0.041*	0.191*	0.102*	0.246*	1.000						
(12) Firm Age	-0.074*	0.061*	0.067*	-0.047*	0.071*	0.041*	0.001	-0.012	0.053*	0.104*	-0.014	1.000					
(13) Female Presence	-0.011	0.059*	-0.031	0.125*	-0.087*	0.099*	-0.045*	-0.038*	-0.031	0.057*	0.265*	-0.040*	1.000				
(14) Employee's Education	-0.043*	0.248	0.052*	-0.018	0.053*	0.158*	0.011	0.100*	0.043*	-0.052*	0.067*	0.051*	0.029	1.000			
(15) Employee's Work Experience	0.061*	-0.032	0.097*	-0.034	0.086*	-0.076*	0.025	0.019	0.095*	0.022	-0.016	0.120*	-0.009	-0.009	1.000		
(16) Employee's Work-Study Coherence	-0.007	0.122*	0.007	-0.061*	0.088*	0.081*	-0.005	0.160*	0.012	0.040	0.074*	0.009	0.024	0.215*	0.010	1.000	
(17) Employee's Age	0.006	-0.025	0.028	-0.005	0.000	-0.073*	-0.006	0.020	-0.018	0.009	-0.020	-0.006	0.024	0.019	0.199*	-0.030	1.000

Table 3 Hiring decision (probit models with binary variable "Hiring" as the dependent variable)

	Model 1	Model 2	Model 3	Model 4	Model 5
Entrepreneurial Experience	0.189 (0.071)***	-0.105 (0.158)	0.189 (0.071)***	0.189 (0.071)***	0.190 (0.071)***
High Education	-0.068 (0.083)	-0.074 (0.083)	-0.112 (0.164)	-0.067 (0.083)	-0.065 (0.083)
Managerial Experience	0.079 (0.077)	0.081 (0.077)	0.079 (0.077)	0.163 (0.168)	0.074 (0.077)
Necessity-driven Motivations	-0.113 (0.104)	-0.116 (0.104)	-0.113 (0.104)	-0.116 (0.104)	0.199 (0.204)
R&D Investments	0.379 (0.082)***	0.256 (0.101)**	0.338 (0.154)**	0.406 (0.096)***	0.438 (0.089)***
Entrepreneurial Exp. x R&D Investments	-	0.365 (0.174)**	-	-	-
High Education x R&D Investments	-	-	0.056 (0.181)	-	-
Managerial Exp. x R&D Investments	-	-	-	-0.103 (0.186)	-
Necessity-driven Mot. x R&D Investments	-	-	-	-	-0.411 (0.232)*
Academic Experience Abroad	-0.189 (0.072)***	-0.184 (0.072)**	-0.189 (0.072)***	-0.189 (0.072)***	-0.190 (0.072)***
Work Experience Abroad	0.075 (0.066)	0.080 (0.066)	0.074 (0.066)	0.075 (0.066)	0.074 (0.066)
Work-study Coherence	0.116 (0.106)	0.109 (0.106)	0.117 (0.106)	0.115 (0.106)	0.111 (0.106)
Institutions	0.347 (0.067)***	0.346 (0.067)***	0.346 (0.067)***	0.347 (0.067)***	0.352 (0.067)***
Parents Entrepreneurs	0.132 (0.079)*	0.134 (0.079)*	0.131 (0.079)*	0.133 (0.079)*	0.132 (0.079)*
Team Size	-0.050 (0.027)*	-0.051 (0.027)*	-0.050 (0.027)*	-0.050 (0.027)*	-0.049 (0.027)*
Firm Age	0.281 (0.028)***	0.283 (0.028)***	0.281 (0.028)***	0.282 (0.028)***	0.282 (0.028)***
Female Presence	0.058 (0.075)	0.053 (0.075)	0.059 (0.075)	0.056 (0.075)	0.051 (0.075)
Constant	-1.886 (0.447)***	-1.852 (0.429)***	-1.759 (0.462)***	-1.941 (0.433)***	-1.960 (0.432)***
Regional Dummies	Included	Included	Included	Included	Included
Log Likelihood	-1,054.036	-1,051.881	-1,053.582	-1,053.930	-1,052.5202
Pseudo R^2	0.103	0.105	0.104	0.103	0.105

Standard error in parentheses. * < 0.10; ** < 0.05; *** < 0.01. All two-tailed tests. Number of observations is 1,696

Table 4 Employee's human capital and assortative matching with entrepreneurs' human capital (Heckman two-stage model, second stage equation)

	Model 1	Model 2	Model 3	Model 4
Dependent Variable	*Employee's education*	*Employee's work experience*	*Employee's work-study coherence*	*Employee's age*
Entrepreneurial Experience	-0.015 (0.031)	0.099 (0.034)***	-0.006 (0.023)	1.309 (0.613)**
High Education	0.232 (0.033)***	-0.033 (0.040)	0.062 (0.028)**	-0.711 (0.710)
Managerial Experience	-0.004 (0.031)	0.106 (0.036)***	-0.031 (0.025)	1.283 (0.654)**
Necessity-driven Motivations	-0.107 (0.047)**	-0.002 (0.050)	-0.110 (0.037)***	-1.147 (1.066)
R&D Investments	0.066 (0.035)*	0.089 (0.038)**	0.084 (0.027)***	0.420 (0.632)
Academic Experience Abroad	0.101 (0.031)***	-0.091 (0.033)***	0.035 (0.023)	-2.364 (0.594)***
Work Experience Abroad	-0.002 (0.027)	-0.007 (0.032)	-0.017 (0.022)	0.133 (0.565)
WorkSstudy Coherence	0.060 (0.042)	0.022 (0.051)	0.172 (0.042)***	2.064 (0.862)**
Institutions	0.074 (0.031)**	0.071 (0.032)**	-0.001 (0.022)	1.776 (0.604)***
Team Size	0.001 (0.010)	-0.002 (0.012)	0.009 (0.008)	-0.042 (0.248)
Firm Age	0.032 (0.017)*	0.045 (0.012)***	0.007 (0.007)	1.538 (0.197)***
Female Presence	0.032 (0.031)	0.024 (0.036)	0.037 (0.023)	0.693 (0.624)
Constant	-0.084 (0.135)	0.114 (0.074)	0.473 (0.061)***	22.854 (1.310)***

Standard error in parentheses clustered at the firm-level. * < 0.10; ** < 0.05; *** < 0.01. All two-tailed tests. Number of employee-level observations is 2,974.

FIGURES

Figure 1 Predicted probabilities to hire employees for entrepreneurs with and without entrepreneurial experience in high and low R&D intensive startups

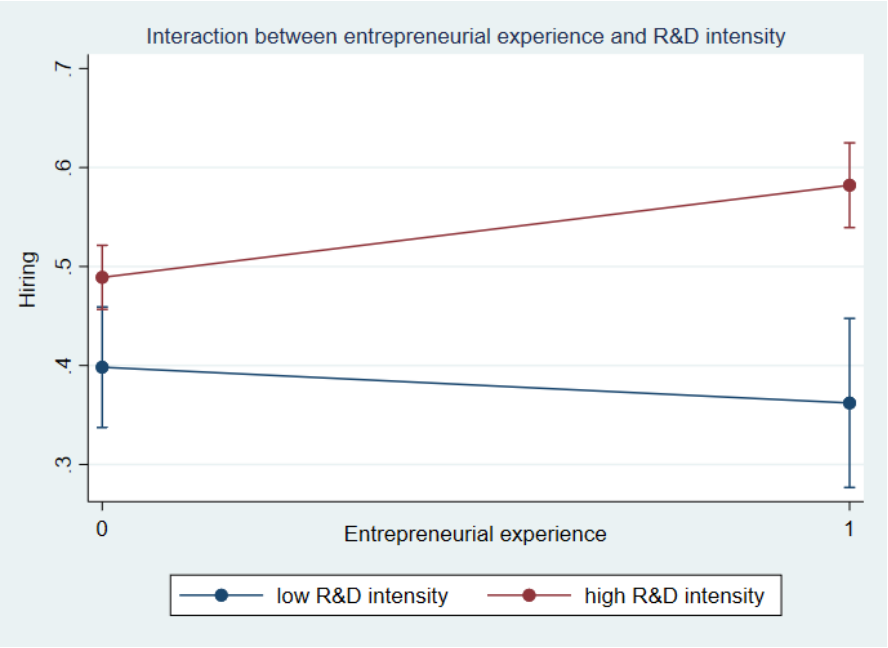
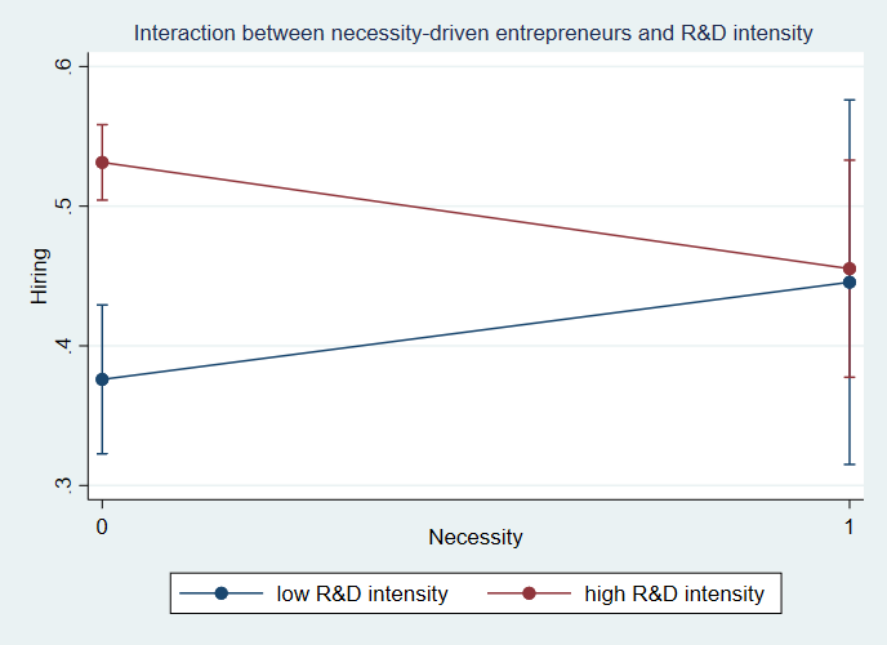


Figure 2: Predicted probabilities to hire employees for necessity and non-necessity driven entrepreneurs in high and low R&D intensive startups



APPENDIX

Table A1 Hiring decision – regression results from probit model (average marginal effects) with hiring (1) versus no hiring (0) as dependent variable

Dependent variable	Hiring
Entrepreneurial experience	0.067 (0.025)***
High education	-0.024 (0.029)
Managerial experience	0.028 (0.027)
Necessity-driven motivations	-0.040 (0.037)
R&D investments	0.134 (0.029)***
Academic experience abroad	-0.067 (0.025)***
Work experience abroad	0.026 (0.023)
Work-study coherence	0.041 (0.037)
Institutions	0.123 (0.023)***
Parents entrepreneurs	0.047 (0.028)*
Team size	-0.018 (0.009)*
Firm age	0.100 (0.009)***
Female presence	0.020 (0.027)

Standard error in parentheses. * <0.10; ** < 0.05; *** < 0.01. All two-tailed tests. Number of observations is 1,696. Regional dummies are included

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Paper C. Entrepreneurship Policy and The Financing Of Young Innovative Companies: Evidence From The Italian Startup Act

Abstract

While there is a general consensus that young innovative companies (YICs) need special attention by public policy which should aim at alleviating the financial constraints these firms commonly suffer, much less agreement has been reached on the most effective policy instruments reputed to accomplish the task. In this respect, if the scientific debate has very much revolved around the dilemma about the crowding-in or crowding-out effect of public R&D subsidies to firms, there is a dearth of scientific studies which analyse the effectiveness and potential interrelations of different policy instruments which at the same time and in the same institutional context are offered to YICs. By taking advantage of the Italian Startup Act issued in 2012, we analyse, for the first time, the possible existence of interrelationships between firm access to a Government-guaranteed (GG) bank loan program and fiscal incentives for Venture capital (VC) equity investments. Results suggest two important facts. First, the two mechanisms appear to be functional to different typologies of YICs. Second, VC investments significantly reduce the probability to access GG bank loans. Overall, our analysis highlights a sort of "institutional division of labour" between the two measures and depicts what we label as a *Task segmentation effect*.

Keywords: Young Innovative Companies; Venture Capital; Government-guaranteed bank loan; Entrepreneurship Policy; Policy Measures Coordination

JEL Codes: 038; G24

1. Introduction

Entrepreneurial activity in technological advanced sectors is deemed to be a major source of innovation, qualified employment and economic growth (Schumpeter, 1911). Recently, the scientific literature has increasingly focused its attention on the so-called Young Innovative Companies (YICs). Mas-Tur and Moya (2015, p. 1432) identify YICs as small and young firms "with great potential to develop innovations for commercial applications and create value for society" (see also Schneider and Veugelers, 2010; Czarnitzki and Delanote, 2013). These firms are characterized by a specific attitude to grasp technical innovation, they often stimulate the development of new technological paradigms, play a disciplining role towards established leading incumbents, open up new market segments and favour the flow of knowledge and competencies inter- and intra- several industries (Timmons and Spinelli, 2003; Aghion and Howitt, 2005). Accordingly, these typologies of companies have attracted the interest not only of academics but also of many other actors in modern economies, first among everyone, policy makers.

For a long time, governments have designed and implemented several types of interventions in order to alleviate those financing constraints that may hamper the birth and the growth of high-potential YICs and related typology of firms. Policy makers need to step in, as long as these firms are likely to invest less than social optimum. Two main reasons are universally acknowledged to explain the gap between private firms' investment and its social optimum level. First, the presence of important knowledge spillovers in innovative activities (Nelson, 1959; Arrow, 1962; Teece, 1986; Hall and Lerner, 2010), which may hamper YICs that suffer from inefficient mechanisms of protection of their R&D investment. Secondly, the existence of relevant capital market imperfections which are specifically severe for young and risky startups (Hall, 2002; Revest and Sapio, 2012). Hall and Lerner (2010) provide a list of the reasons which can create a gap between external and internal sources of financing for an innovative company: (i) asymmetric information between entrepreneurs and investors causing an adverse selection problem, (ii) agency costs induced by moral hazard, (iii) taxation favouring the financing of innovation through retained earnings instead of raising new capital.

Therefore, YICs' chances of obtaining external financing would be made impervious and, as a matter of fact, restricted by the presence of information asymmetries between the company and potential financiers (Peneder, 2008), which give often rise to adverse selection and moral hazard problems among the two parties (Leland and Pyle, 1977; Carpenter and Petersen, 2002). Things get also worse, making more stringent the financial constraints suffered from YICs, because this typology of firms usually lacks stable cash flows, a solid track record and, most important, collaterals since YICs usually rely to a great extent on intangible resources (Hall, 2002).[1]

Therefore, if there is a general consensus among both academics and policy makers on the need of direct policies capable to effectively address the financing needs of YICs, much less agreement is discernible on the subsequent question of *which* policy should be put in place (e.g. see Schneider and Veugelers, 2010). In other words, the fundamental question of how, and if, governments are really able to sustain innovative entrepreneurial activity is far from being resolved.

In particular, several attempts have been implemented by different public institutions in order to ease firms' access to financial resources. Specifically, government interventions have tried to reduce YICs' financial constraints through instruments like direct subsidies for R&D and internationalization activities, intellectual property right protection, taxation and fiscal incentives for investors, stimulation of capital markets through equity and venture capital (VC) programs, microfinance and loan guarantee schemes (Minniti, 2008). Admittedly, different governments, at different latitudes, have often opted for different instruments on the basis that policy strategies should be tailored to specific institutional and regional contexts to be truly effective (Wagner and Sternberg, 2004). But, despite a broad literature investigating the role of entrepreneurship policy (Storey, 2003), several issues about the validity and efficacy of these specific interventions are yet to be fully explored (Minniti, 2008). One of

[1] Interestingly, Mann (2017) shows that some innovative companies may to some extent also rely on patents, which can be pledged as collateral to borrow financial resources. Patents can also be used by startups as signalling devices towards external parties (including financiers and investors, see e.g. Hsu and Ziedonis, 2013). However, patents could often be out-of-reach for many YICs, for several reasons, including their non-negligible costs, the low appropriability of innovation in specific industries and the difficulty in evaluating intellectual property rights (Hochberg et al., 2018).

the main problems of this stream of literature on entrepreneurial policy evaluation (see for example the case of public R&D subsidies documented by the scientific review of Zúñiga-Vicente et al., 2014) is that the effectiveness of policy instruments is often analysed in 'isolation'. In other terms, the circumstance that firms are embedded in diverse institutional contexts and are potentially the target of different policy-driven schemes has been largely overlooked in the empirical analyses on the efficacy of policy measures (Grilli et al., 2018a).

In this regard, we argue about the necessity to better understand which typology of firms get access to which type of measures, for then gauging the eventual synergistic effects potentially stemming from the co-existence of different public policy measures available to YICs. Equally important, there is the need to perform this analysis in a controlled institutional setting.

In this respect, the recent Law no. 221 introduced in Italy in 2012 (the "*Italian Startup Act*", i.e. also known in Italy as "Decreto Crescita 2.0") and specifically devoted to the support of YICs, offers a valuable opportunity. In fact, we can observe the (eventual) matching between funding suppliers and startups in the presence of an exogenous policy shock which enhanced the available external financing opportunities for a category firms, i.e. YICs, which has been defined by the policy and that we observe from the beginning of the policy change. This setting should rule out the possibility that the investment dynamics we observe might (at least to some extent) be driven by endogenous self-reinforcing mechanisms arising throughout time in the industry.[2] Secondly, the policy scheme includes *at the same time* two of the most important and widely adopted measures for the support of the YICs' demand for capital: (i) a program that envisages fiscal incentives for venture capitalists and outside investors who invest in equity capital and (ii) privileged access for YICs to a Government-guaranteed (GG) bank loan program. Venture capital (VC) is often considered for its inherent characteristics as the

[2] For example, imitation and isomorphic attitudes (DiMaggio and Powell, 1983) towards successful role models emerging in specific geographical areas have been found to largely and permanently affect the differences in the characteristics of startups operating in the biotechnology industry in the US across different regions (Packalen, 2015). While, in our case, observing YICs from their inception and at the beginning of the institutional change brought in by the policy law, should enable us to analyse the matching between fund providers and YICs in a pure and 'untainted' environment.

preferred financing source for YICs (Gompers and Lerner, 2001). VC investors are deemed to better overcoming information asymmetries than other capital market operators (Sahlman, 1990); they provide financial resources but also 'add value' to YICs along a series of important dimensions on which YICs often lack managerial skills and competencies (Hellmann and Puri, 2002). But, even when considering the most developed equity-based financial system like the United States (US), the VC industry ends up financing only a very small fraction of startups (Mulcahy, 2013). As a matter of fact, particularly in bank-based systems like Italy or continental Europe, YICs have to rely on bank debt as the primary source of external financing (Colombo and Grilli, 2007).[3]

Thanks to the Startup Act here considered, all Italian YICs were potentially subject with the same degree of exposure towards the two potential *treatments* (i) and (ii) above mentioned. We are therefore in the condition to properly investigate the mutual interdependencies arising between the two different sources of financing (and the underlying policy mechanisms). Specifically, we aim at addressing the following questions: do these measures target YICs with similar characteristics or, conversely, do they serve different typologies of YICs? Can these measures be considered complementary, i.e. access to one type of measure eases access to the other type of measure; or conversely substitute, i.e. access to one type of measure depresses access to the other type? Is there any signalling effect (i.e., 'certification effect', see Lerner, 2002) exerted by the GG bank loans program towards VC investors? Do VC investments have an impact on the likelihood to obtain guaranteed bank loans by YICs?

In order to investigate these issues, we consider a sample of 2,526 Italian YICs and resort to the estimation of a dynamic bivariate survival model (Mosconi and Seri, 2006; Colombo et al., 2007) to highlight simultaneously the determinants of YICs' access to both these modes of financing and the possible existence of substitutability and/or complementarity effects between Government-

[3] Benfratello et al. (2008), among others, underline the importance of bank support to Italian YICs and show a positive effect of local banking development on firms' innovative activities.

guaranteed bank loans and VC investments (i.e. whether access to one financing mode decreases or increases the probability for a YIC to access the other mechanism).

The results of our analysis offer unprecedented insights on the financial needs of YICs and deliver important implications in this respect for entrepreneurs, investors and policy makers. In a nutshell, our findings highlight that the two measures serve different types of YICs. In addition, we highlight that YICs obtaining VC funds are less likely to access GG bank debt thereafter.

The remaining of the paper is organized as follows. Section 2 highlights the background literature. Section 3 describes the Italian Startup Act. Section 4 illustrates the methodology and describes the data. Section 5 reports on the empirical analysis, including details on additional evidence and robustness tests produced. Section 6 concludes with final remarks.

2. Literature review and research hypotheses

2.1 Young Innovative Companies, financial constraints and investors

YICs are reputed to experience troubles in accessing financial resources, compared to established companies and other young ventures characterized by lower innovativeness: this particularly applies to (European) bank-based economies and it is clearly shown by cross-national surveys (see the European Investment Fund report by Kraemer-Eis et al., 2014) and by the academic literature (see the survey of the literature by Revest and Sapio, 2012). The success of innovative ventures heavily relies on investments in R&D activity, marketing expenses to promote new products and commercialise innovation, resources to hire qualified personnel (Beck and Demirguc-Kunt, 2006). Yet, YICs are generally riskier and failure rates are high (Coad and Rao, 2008); they rely on intangible assets, that can be hardly used as collateral for lending (O'Sullivan, 2005). Moreover, they need money for the long run: any interest payment in the startup phase diverts resources from value creation and increases the cash burn rate (Giudici and Paleari, 2000; Mazzucato, 2013). Therefore the access to debt financing through bank loans, which is one of the most common sources of finance for

established companies, is a challenge for YICs (Freel, 2007), unless relevant guarantees are provided by the founders, this harming their entrepreneurial boost. The advent of the global financial crisis contributed to further reduce the supply of capital for YICs (North et al., 2013; Lee et al., 2015) especially from banks, and to increase the cost of outside capital.

Equity capital provided by outside professional investors like venture capitalists (VCs) is typically pointed out as the solution to the credit rationing problem (Mina et al., 2013) and to adverse selection and moral hazard problems (Carpenter and Petersen, 2002). VC investors have superior screening capabilities and are typically selective (Sahlman, 1990), require a number of contractual clauses in order to protect their investment (e.g. veto power, super-majority voting, drag-along and tag-along clauses, governance agreements, board representation) and work alongside the founders to increase the value of the venture, by providing managerial competencies, networking and marketing advice (Hellmann and Puri, 2002; Gompers and Lerner, 2004; Ueda, 2004). Bertoni et al. (2011) show that VC investments positively influence firm growth: the treatment effect of VC investments is of large economic magnitude, especially on the growth of employment. More generally, most of the available empirical evidence largely supports the claim of a positive impact of VC on firm performance, basically irrespective of the latitude and the timing on which analyses are carried on (e.g. Manigart and Van Hyfte, 1999; Kortum and Lerner, 2000; Engel and Keilbach, 2007; Puri and Zarutskie, 2012; Cumming et al., 2017).

2.2 Bank's lending and venture capital financing

Bankers and venture capitalists face the problem of information asymmetry when assessing lending applications and evaluation of investment opportunities. These problems are particularly severe when the request comes from new businesses (Binks and Ennew, 1997; Storey, 1994) but, due to the different type of investments, the risks for a commercial bank and a VC are not the same. Banks receive contractually-determined interests and the paid-back principal: they can suffer relevant losses if the YIC fails, but they have no opportunity to gain an upside. Therefore, banks suffer from two types

of risks (Parker, 2002): *adverse selection* – lending a failure business (type 1 error), or not lending a successful business (type 2 error) – and *moral hazard* risk, given that the bank is unable to monitor entrepreneurs activity after the loan concession (Binks and Ennew, 1997). In this perspective, banks consider two important issues before lending: the presence of a collateral and the ability for the company to generate cash flows to pay back the principal and the interests (Wynant et al., 1991). Unlike banks, VCs subscribe equity capital and have a residual claim compared to debt holders. On one hand, they are fully exposed in the business failure and they face the possibility that their investment will be illiquid if the new venture does not grow significantly, but on the other hand they enjoy all the upside benefits of success, so they would appreciate high-risk high-return projects while lenders could be more prone to finance startups with steady and foreseeable growth path. This raises the question if banks and venture capitalists target the same types of YICs or not. Even if the financial issues are an important driver, VCs in their investment criteria put great emphasis on the capability of the management team (Muzyka et al., 1996), product characteristics, market characteristics and potential returns (Manigart et al., 1997).

2.3 Policies for the financial needs of Young Innovative Companies

Despite the "near universal recognition of the presence of market failures in the provision of finance" for YICs and high-tech startups (Storey and Tether, 1998, p. 1049; see also Hall, 2005), and the alleged consensus on the need for a policy intervention in the field (Schneider and Veugelers, 2010), the debate on the most effective measures to put in place is still quite lively (Colombo et al., 2012). Policy measures generally vary along several dimensions, but crucial factors are usually deemed the channel through which support to companies should be provided (e.g., tax credits, grants, or low interest loans), whether subsidies should be *erga-omnes* for YICs or rather selective, the type of expenditures admissible for public financing, where R&D usually figures prominently. Admittedly, the scientific literature has been of little help in imparting to policy makers clear guidelines on identifying the best mechanisms tailored to each specific institutional context (Wagner and Sternberg, 2004). In fact, much of the scientific debate has revolved around the question of whether public subsidies

(especially R&D grants) crowd-out or crowd-in private monies (Czarnitzki and Fier, 2002; Zúñiga-Vicente et al., 2014). Another more recent lively area of debate, given the positive role attributed to the VC investor depicted above, is whether the public actor should adopt a 'hands-on' approach and constitute large governmental venture capital funds or, more generally, whether its (direct or indirect) intervention is really able to trigger the development of a florid venture capital industry (Manigart and Beuselinck, 2001; Leleux and Surlemont, 2003; Cumming and MacIntosh, 2006; Da Rin et al., 2006; Cumming, 2007; Brander et al., 2012; Grilli and Murtinu, 2014; Cumming et al., 2017). While the political discussion is very much open about these issues, from a scientific point of view, it is argued that one of the major deficiencies in the literature is traceable in the rather Manichean perspective adopted by most studies (see Colombo et al. 2011; Grilli et al., 2018a). In fact, the typical study in the field analyses the effects of a specific policy measure *in isolation* with respect to (i.e. without taking into account) other possible alternative policy measures firms may have access to. In doing so, it is impossible to understand whether different firms select themselves to different instruments and/or self-select themselves out from others, by relegating the analysis to provide, in the best scenario, only a partial picture and, in the worst case, a biased representation. Secondly, eventual mutual interrelationships arising between different policy measures targeted to YICs have largely remained unexplored. Specifically, although the theme of industrial policy coordination has been investigated from both a theoretical (Cooper and John, 1988; Durlauf, 1993) and an empirical point of view (Rodrik, 1996), the possible rise of policy coordination failures and/or synergies in the specific domain here considered has never been investigated before. This raises our second question: does incentivized access to either VC equity capital or bank debt impact on the probability to access the other alternative source of capital, in a follow-up round?

2.4 Research hypotheses

Grounding on the research gap, the specific policy reform here considered enables us to explore, within the same institutional reform, two important research questions:

R1. Do Government-guaranteed bank loans and fiscal incentives for VC equity investments flow towards YICs with the same characteristics or, conversely, the two typologies of subsidized investors target rather different YICs?

R2. Does access to one type of subsidized financing measure facilitate or, conversely, depress access to the other source?

By combining the answers to these two research questions, it is possible to ascertain four different scenarios as to the effect of the entrepreneurship policy on the financing of YICs. These scenarios are synthesized in Figure 1. A first scenario is labeled *Shadow effect*. In this case, GG bank loans and subsidized VC investments target very similar YICs, and once accessed one type of financing, the probability for a YIC to access the other is significantly reduced. A second scenario is represented by the *Task segmentation effect*. The two policy measures help different types of YICs, but again access to one type of measure decreases the probability for a YIC to access the other one. Then, the scenario where GG bank loans and subsidized VC investments flow towards the same type of YICs, and then, once accessed one type of measure, a YIC shows greater probability to access the other financing source, is a typical *Matthew effect* (Merton, 1968; 1988). Finally, we define a *Halo effect* (Dollinger et al., 1997; Lerner, 2002; Rosenzweig, 2014) a situation where banks or venture capitalists target different typologies of YICs, and then, access to one type of external funds enhances possibilities for a YIC to get the other source.

[Insert Figure 1]

Our empirical analysis will enable us to ascertain which of these four different policy scenarios is more likely to refer to YICs, in a specific context where all the companies are subjected to the same measures at the same time.

3. The Italian Startup Act

In order to boost the birth of new innovative ventures, in 2012 the Italian Government issued a law (Law no. 221/2012, modified by further amendments, the so-called "*Italian Startup Act*") introducing the possibility for young companies to qualify as a YIC (namely "innovative startup"). This status is reserved to limited liability companies (either Italian companies or branches of EU companies registered in Italy), aged 5 years or younger, operating in technology-related businesses. YICs have also to comply with one of the following three requirements: (i) ownership or licensee of a patent or a registered software or a generic intellectual right, (ii) at least one third of employees must hold a Ph.D. or a research tenure (or at least two third must hold a M.Sc. degree), (iii) investments in R&D should account for at least 15% of the revenues (or operating costs if they exceed the revenues). Until a company qualifies as a YIC, it cannot distribute dividends and cannot be listed on a stock exchange. The annual revenues must be lower than € 5 million and the company must not be originated from a spin-off or a merger of pre-existing operations.

To YICs (as identified by the law) are granted specific incentives, exemptions and access to privileged (and discounted) services. The retroactive nature of the policy allows access to these support measures not only to new ventures but also to already existing YICs that fulfilled the legal requirements. Measures span over different areas, including the access to equity crowdfunding (Giudici et al., 2013).[4] For example, Italian YICs can be incorporated on the Internet through digital identification almost for free and they are exempted from any relevant entry fee otherwise due to the Chambers of Commerce. Or again, employees and consultants can be remunerated with stock options and "work for equity" tools enjoying particular reliefs. Moreover, Italian YICs may benefit from fail-fast mechanisms in case of liquidation, so to allow fresh new starts to entrepreneurs. A brief synopsis of the law (and a comparison with legislation in the other EU Member States) is provided by the European Digital Forum (2016). A complete description of the eligibility criteria and of the support

[4] Before the Startup Act, equity crowdfunding was not allowed in Italy, and it has been reserved to innovative startups only, up to 2015.

measures are available on the governmental website of the Italian Ministry of Economic Development (http://www.mise.gov.it).

As far as the financing side is concerned, which is the focus of our analysis, two are the policy initiatives of interest. The first initiative is a tax incentive scheme to encourage equity investors for YICs' investments. On the basis of the Law, YICs may benefit from robust tax relief on equity investments made by legal entities: a minimum 20% fiscal deduction up to a maximum investment of € 1.8 million. This provision aims at supporting venture capital investors and benefit those YICs which receive equity financing.[5] The second intervention is a loan Government-guaranteed scheme, designed with the aim to overcome market imperfections in the provision of bank loans to YICs. Italian YICs have priority and simplified access to a Government-guaranteed (GG) bank loan fund ("*Fondo di Garanzia*"), which offers a partial public guarantee on bank loans. Specifically, the guarantee covers up to 80% of the credit issued by a commercial bank to the YIC, with an upper limit of € 2.5 million. A YIC must submit its investment plan to the bank, which conducts internally a proper creditworthiness assessment. After that, the bank takes the decision whether to approve the loan request and eventually the guaranteed amount, while "Mediocredito Centrale", the entity that manages the GG fund, makes a simple formal check, without any additional due diligence.

4. Data and Methodology

4.1 Data

The sample analysed in this paper is composed of 2,526 Italian YICs. Sample firms were collected starting from the whole population of Italian YICs at December 8th 2014, amounting to 3,006 firms. Based on this, we built a new hand-collected longitudinal database gathering complete company information available at November 2016. The observation period starts from 2009 although the year

[5] The objective to support outside professional equity investors is underlined by the exclusion from the tax benefit of investors holding more than 30% of the equity capital.

of foundation for (very few) YICs could be antecedent (for the age requirement in the Law, the foundation year for an Italian YIC cannot be antecedent to 2007). The sources through which data have been collected were mainly three. First, comprehensive accounting and demographics firm information were collected through AIDA, i.e. the Italian fine-grained version of the Amadeus-Bureau Van Dijk database. Second, we used the commercial database provided by the Union of Italian Chambers of Commerce, i.e. Telemaco, which registers all business activities started in Italy and provides (upon payment request) information about shareholders composition and firm financial structure and their evolution over time. The one-by-one visual inspection of each firm's official documentation on capital and debt structure throughout its life was instrumental in discerning the subsidized VC-backed YICs from the non-VC-backed ones, and to record the eventual year of the first professional VC investment. Further confirmatory analysis through secondary sources (e.g. specialized press, corporate websites) was applied in order to reliably identify the VC-backed YICs. Third, data on access by firms to the GG bank loans program with the indication of the year of loan disbursement was provided by the Italian Ministry of Economic Development.[6] Firm fiscal codes were used in order to anchor all these data across the three different sources.

Then, other information sources were used to complete the set of covariates. We added information on the geographical location of YICs. Specifically, we used several other secondary sources (e.g. Istituto G. Tagliacarne, InfoCamere, Istat) in order to create socio-economic indicators of the regions (at NUTS 2 level) where YICs are located. Finally, we also included in our analysis variables capturing the contingent phase of the macroeconomic business cycle over years (source: Eurostat).

4.2 Descriptive statistics

As far as the main interest of this study is concerned, the two policy measures seem not to impact equally on the YICs' external financing likelihood (see Table 1). The number of YICs assisted by at least

[6] Data in this respect were strictly confidential and made available to one of the author only for scientific purposes and only thanks to his/her participation to a Ministerial technical committee constituted for the monitoring and evaluation of national policies for the eco-system of Italian innovative startups and SMEs.

one GG bank loan is relatively small (418 companies representing 16.6% of the sample), even so, it is much bigger than the number of YICs backed by subsidized VC investments (276 companies, equal to almost 11%). These data confirm the difficulties to access external financial resources for YICs and the limited size of the VC industry in Continental Europe (Giudici and Roosenboom, 2004). Note also that the number of the firms that accessed both types of financing forms was fairly low, i.e. 48 (1.9%). This is a first and partial indication that accessing both forms of financing is rather unusual for YICs, suggesting a conceivable substitution effect between the two policy measures.

[Insert Table 1]

The last part of Table 1 reports statistics about "second transitions": the number of firms that, being backed by one type of financier, have gained access to the other type and the number of firms that in the same year got access to both VC and GG bank loans. Out of the 48 YICs that received funding from both sources, three-fifths (29 firms) obtained the GG bank loan some years after they were invested by a VC, while seven firms obtained a GG bank loan and afterwards they were backed by a VC. Only 12 firms obtained equity capital and guaranteed debt in the same year.

As for other descriptive statistics not reported in the tables, the total accounting value of the company assets at the end of 2015 was lower than € 100,000 in 37% of the YICs. By the same period, 14% of the firms had not obtained any revenue yet; while only 29% (741 companies) had overcome the threshold of € 100,000 in terms of total revenues, with several YICs still in the early stages of their life (sampled YICs are 3.5 years old on average). Even though the Law no. 221/2012 included specific measures aimed at easing the hiring of the workforce, at the end of 2015, 55% of the YICs still relied entirely on the self-employment of entrepreneurs, and 45% declared salaried employees. As a matter of fact, only 18% of the startups employed more than three individuals.

4.3 The econometric model

We model a YIC's likelihood to access VC and/or GG bank loans using a dynamic bivariate discrete-time stochastic process. The description of the method is based on Mosconi and Seri (2006) and Colombo et al. (2007). This statistical approach is specifically designed for non-causality analysis in a

dynamic process in which the conditions for Granger non-causality can be tested and represented through a Wald test (Mosconi and Seri, 2006). Based on the structure of our dataset, the dynamic process is assimilated to a bivariate discrete-time survival process, where a transition occurs each time a YIC get access to one of the two different types of external funds in a specific year.

We define a binary variable $y_{it}^{j} (j \in \{A, B\})$; $y_{it}^{A} = 1$ if firm *i* accesses VC (state A) by the year *t* and $y_{it}^{A} = 0$ otherwise; and $y_{it}^{B} = 1$ if firm *i* accesses GG bank loans (state B) by the year *t* and $y_{it}^{B} = 0$ otherwise, with $t \epsilon \tau = \{t_i^E, \dots, T\}$. t_i^E is the foundation year of the firm *i*, *T* is the last year of the observation period, i.e. 2016. For all YICs, at year *t,* only four different states of nature are observable: 0 = [0,0]; 1 = [1,0]; 2 = [0,1]; 3 = [1,1]. The state 0 is relative to YICs that obtained neither VC funds nor GG bank loans. State 1 identifies VC-backed firms that did not access GG bank loans, state 2 captures YICs that obtained a GG bank loan but which are not VC-backed, while state 3 indicates access to both VC and GG bank loans.

A peculiar case of the Mosconi and Seri (2006) model can be obtained when some of the transition probabilities are set to zero. The discrete-time binary model used in this study contemplates five different possible transition probabilities (as Figure 2 illustrates). From state 0 to state 1 or to state 2 the transitions are defined as *first transitions*, instead transitions from states 1 or 2 to state 3 and from 0 to 3 are defined as *second transitions*. The model is defined as an *absorbing states model* (Mosconi and Seri, 2006) and it assumes that transitions between states are irreversible. Formally, this means that a firm which has reached the states $y_{it-1}^{j} = 1$ at year *t-1* will not go back to $y_{it}^{j} = 0$ at year *t*. It means that the transitions from state 1 to state 1 (an additional VC investment), state 2 to 2 (the access to a new GG bank loan) and from state 3 to state 3 are defined as 'no transition' and the status remained the same as the one in year *t-1*. Accordingly, this also means that the probability of a YIC of being VC-backed (GG bank-backed) at year *t* if it was already VC-backed (GG bank-backed) at year *t-1* is equal to 1.

The model adopts a latent regression approach and poses the assumptions that all firms *i* access GG bank loan or VC (variable *j*), if a latent continuous random variable y_{it}^{*j} exceeds a threshold level,

that without loss of generality is set equal to zero. Given that the variable y_{it}^{*j} depends on the firm *i*'s states of nature at year *t-1*, the dynamics are modelled as a typical first-order *Markov chain* process. The stationary assumption of transition probabilities implied by a strict first-order Markov process is then relaxed by modelling YIC's access to the two different forms of financing, as a function not only of past realizations of the endogenous variables, i.e. state of nature at year *t-1*, but also as a function of a set of time-varying and unvarying covariates. Following recommendations by Mosconi and Seri (2006), in our analysis all time-dependent YIC-specific explanatory variables which may be correlated to firm access to VC or GG bank loan at year *t*, have been lagged at *t-1*, in order to alleviate possible reverse causality problems. Finally, in order to exploit all the available relevant information concerning first transition probabilities in the event that YICs obtain VC and/or GG bank loan during their foundation year, we construct a variable indicating whether a firm is less than one year old. In other words, the variable $Dseed_{it}$ is defined as follows:

$$Dseed_{it} = \begin{cases} 1 & t = t_i^E \\ 0 & t > t_i^E \end{cases}. \quad (1)$$

Lagged time-varying firm-specific explanatory variables (e.g. firm size in terms of employees or firm leverage) are by construction not defined before firm's foundation. The same applies to the lagged endogenous variables of the model, as before foundation firms do not belong to any state of nature. Therefore, these *m* variables are included in the column vector $k_{it-1} = (k_{1it-1}, \dots, k_{mit-1}) \in \mathbb{R}^m$ that cannot influence firms' probability of accessing external funds at $t = t_i^E$. Accordingly, in the specification of the model these independent variables are multiplied by (1-$Dseed_{it}$). While, we define another set of *h* explanatory variables included in vector $z_{it} = (z_{1it}, \dots, z_{hit}) \in \mathbb{R}^h$, as formed by those time-varying determinants (e.g. firm age, number of managers) which are unlikely to be endogenous and by the time-unvarying covariates (e.g. location specific and macroeconomic variables) which can meaningfully be defined at the foundation year and may exert an impact on firms' access to both forms of financing even in the foundation year.

Hence for a YIC that was not financed by a VC investor and did not access any GG bank loan (i.e. it starts from state 0), the latent regression system is:

$$y_{it}^{*A} = \propto_A z_{it} + \beta_A k_{it-1}(1 - Dseed_{it}) + \varepsilon_{it}^A,$$
$$y_{it}^{*B} = \propto_B z_{it} + \beta_B k_{it-1}(1 - Dseed_{it}) + \varepsilon_{it}^B. \quad (2)$$

Where α_A and α_B are row vectors of coefficients associated to the time-varying covariates, and $\beta_A$and β_B are the vectors of the regression coefficients corresponding to the lagged time-varying variables.

In a multivariate probit setting the standardized bivariate normal distribution for error terms is assumed, for $\varepsilon_{it}^j = (\varepsilon_{it}^A, \varepsilon_{it}^B)$:

$$\begin{pmatrix} \varepsilon_{it}^A \\ \varepsilon_{it}^B \end{pmatrix} \sim iidN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right), \quad (3)$$

where *ρ* represents the correlation between the error terms of the latent regressions. Accordingly with Mosconi and Seri (2006), in order to maximize the likelihood function without using constraints, the correlation is reparametrized in a logit-type functional form:

$$\rho = \frac{\exp(\gamma_0) - 1}{\exp(\gamma_0) + 1}. \quad (4)$$

It follows that the probability of moving to state 1 or 2 or 3 at year *t*, provided that firm *i* is in state 0 at year *t-1*, can be modelled through a bivariate survival model. This means that:

$$P\{y_{it} | Y_{it-1} = (0,0), x_{it}\} = \Phi_2\left(\begin{bmatrix} \alpha_A z_{it} + \beta_A k_{it-1}(1 - Dseed_{it}) \\ \alpha_B z_{it} + \beta_B k_{it-1}(1 - Dseed_{it}) \end{bmatrix}; 0, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right). \quad (5)$$

Where $\Phi_2(\cdot; \mu, \Sigma)$ denotes the bivariate normal distribution, with mean μ and covariance matrix Σ. For a YIC which has obtained VC funds at year *t-1* (i.e. it is in state 1), the only possible transition at year *t* is the one that brings the firm to get also access to the GG bank loan program (i.e. from state 1 to state 3). Hence, the underlying latent regression for the access to the GG bank loan after obtaining a VC investment is:

$$y_{it}^{*B} = \alpha_B z_{it} + \beta_B k_{it-1}(1 - Dseed_{it}) + \beta_B y_{it-1}^A (1 - Dseed_{it}) + \varepsilon_{it}^B, \quad (6)$$

which gives rise to the univariate probit model:

$$P\{y_{it}^{B}|Y_{it-1}=(1,0)\}=\Phi_1(\alpha_B z_{it}+\beta_B k_{it-1}(1-Dseed_{it})+\beta_B y_{it-1}^{A}(1-Dseed_{it});0,1). \quad (7)$$

Where Φ_1 represents the standard normal distribution with mean 0 and standard deviation 1.

Similarly, for transiting from state 2 to state 3, as defined by the latent regression model, we will have:

$$y_{it}^{*A}=\alpha_A z_{it}+\beta_A k_{it-1}(1-Dseed_{it})+\beta_A y_{it-1}^{B}(1-Dseed_{it})+\varepsilon_{it}^{A}, \quad (8)$$

which leads the univariate probit model to be formulated as follows:

$$P\{y_{it}^{A}|Y_{it-1}=(0,1)\}=\Phi_1(\alpha_A z_{it}+\beta_A k_{it-1}(1-Dseed_{it})+\beta_A y_{it-1}^{B}(1-Dseed_{it});0,1). \quad (9)$$

The model is estimated through the maximum likelihood method. Parameter β_A (β_B) captures the increase in the probability of getting a VC (GG bank loan) once a firm has obtained a GG bank loan (VC). Therefore, coefficients β_A and β_B offer an immediate test of the Granger causality relationship related to the likelihood for the YICs to access GG bank loan once backed by a VC (and vice versa). The Granger non causality condition is tested in a single step, using the Wald Test. Then, the hypothesis that the simultaneous access to VC financing and GG bank loan is more likely to occur than the recourse to each source of financing in isolation is verified through a Wald test for the parameter γ_0 (Table 4), which drives the correlation coefficient ρ (see Mosconi and Seri 2006, p. 403) introduced in Equation 4.

4.4 Variables

The investigation about the probability for the Italian YICs to access subsidized VC and GG bank loans is carried out using a large set of covariates underpinned by the scientific literature discussed in Section 2. Variables can be grouped into four different categories: firm-specific, location-specific, macroeconomic-specific and sector-specific variables (see Table 2).

[Insert Table 2]

Firm-specific variables are related to the company characteristics, taking into account age, size, financial structure and assets' profitability. According to Mina et al. (2013) and Beck and Demigurc-Kunt (2006), company age and size are important determinants of firms' access to external finance, since younger and smaller ventures are considered riskier than more mature and larger counterparts.

In particular, startup age is captured by both the variable $Dseed_t$, a dummy that identifies firms in their foundation year, and by the variable Age_t which measures firm age at year *t*.[7] To describe the size of the YIC, we make use of the number of employees at year *t-1* ($Employees_{t-1}$). On the one hand, venture capital investors are naturally inclined to invest into seed and startup projects in an early phase (Barry, 1994), but on the other hand they will not consider too small entrepreneurial initiatives (Gompers and Lerner, 2004). Banks are usually inclined to deny credit to younger businesses, but their attitude can be different when the loan is partially guaranteed, for example to gain new customers (Binks and Ennew, 1997). As a further variable for size, we also use the natural logarithm of the total assets owned by the company ($LnTotAsset_{t-1}$) (Bougheas et al., 2006).[8] In this respect, we expect a positive impact of the value of company assets on the probability to access the two instruments, especially GG bank loans: banks, in fact, should be particularly sensitive to the quality of the assets which may serve as collateral in case of firm default (Ueda, 2004; Beck and Demirguc-Kunt, 2006).[9]

Then, following Hellmann and Puri (2002), and their argument about the importance of professionalization of startups as a driver criterion for venture capitalists, we introduce the variable $N\_Manager_t$ counting shareholders and managers who have an "active" role in the governance of the startup, at year *t*.[10] Accordingly, we expect a positive impact of this variable on YICs' access to VC (Mason and Stark, 2004).

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[7] Note that the maximum value for the variable Age_t exceeds 5 years and it is equal to 9. In fact, the retroactive nature of the law allows for companies incorporated before 2012 to have the status of YIC for a reduced time span (5 years or less). So the period of investigation goes even beyond the time window envisaged by the Law no. 221/2012. This represents an advantage in our context since it enables to better investigate the presence of possible interrelationships between the two financing modes, and in particular, to verify whether YICs subsidized by a GG bank loan could access venture capital investments even beyond the subsidization period.

[8] The correlation between $Employees_{t-1}$ and $LnTotAsset_{t-1}$ is equal to 0.309. To avoid any possible concerns related to multicollinearity, the two variables were entered into the regressions both separately and jointly, always revealing a similar impact both in economics and statistical terms. The correlation matrix of all explanatory variables is available in appendix, Table A1.

[9] We must remember that the government grants the guarantee only on a portion of the bank loan. Therefore the lender faces the credit risk on the residual part.

[10] This firm-specific variable was introduced into the model specification considering the value at time *t*. However, note that introducing into model specification this variable at time *t-1* leaves our findings totally unaltered (results available upon request from the authors).

Leverage$_{t-1}$, defined as the ratio of the financial debt to total assets at year *t-1*, captures YIC's financial structure. Baum and Silverman (2004) argue that VCs invest in more leveraged firms, while Mina et al. (2013) find that less leveraged firms are preferred. The company profitability is a further variable examined by investors (Mina et al. 2013); yet both equity investors and banks will consider prospect profitability, more than current profitability. Therefore, on *a priori* ground, we do not expect any strong association in this case. As a proxy of the startup profitability and efficiency of the investments, we use the ROA (return on assets), that is the ratio between the operating margin and the total assets of the YIC at year *t-1*.[11] The *ROA*$_{t-1}$ (the ROA lagged at year *t-1*) figure gives investors an idea of how effective the company is in converting the money it invests into net income (Díaz-Díaz et al., 2008; Robb and Watson, 2012; Robinson, 1999; Rothaermel, 2001).

Turning to the location-specific group, four explanatory variables were gathered. The goal of geographical variables is to highlight the effect of the regional (at NUTS 2 level) economic and entrepreneurial ecosystem in which firms are embedded on the YICs' probability to take advantage of the two different policy measures here investigated. A number of studies highlighted the importance of the heterogeneity of the local environment (e.g. wealth distribution, infrastructure availability, industrial clusters, local social capital), in determining access to finance by entrepreneurial ventures (Fritsch and Noseleit, 2013; Giudici et al., 2018). *DSouth* is a dummy variable which assumes value 1 for companies located in the south of Italy, where this area turns out to be historically the least economically developed of the country. In this respect, it is interesting to investigate if the two investigated policy measures help YICs located in this specific disadvantaged area to lessen their financial constraints more than YICs located elsewhere. In the same vein, we introduce into the model three other variables which aim at capturing the infrastructural context and entrepreneurial ecosystem on which YICs operate and that may ease their access to the two forms of financing. *Industrial Intensity* is the ratio between the number of active firms in the focal region over the number

[11] To avoid problems with results dominated by a few outliers, we winsorized the variable by cutting the 0.5% of the left and right tails of the *ROA*$_{t-1}$ distribution.

of hundreds of residents, in the year 2012; *Value Added* computes, in percentage terms, the regional contribution to the national value added in the year 2011; while *Infrastructure* is a composed index referring to the year 2011 and capturing the regional infrastructural and economic endowment in terms of transportation and logistics facilities, telecommunication networks development and capillarity of banking services.

Finally, we include a set of industry and business cycle control variables. Among others, Da Rin et al. (2006) underlined the importance of controlling for macroeconomic factors in explaining firms' access to finance. In detail, we use dummy variables to control for the yearly national deficit on the overall GDP (*Deficit/GDP*$_t$), for the yearly growth of the real GDP (*GDPGrowth*$_t$) and for the industry in which firms operate (*Manufacturing*, *R*&D, *Software* and *General Services*).

Table 3 illustrates the descriptive statistics for the explanatory variables. The logarithm of the total assets ranges from 0 to 16.380, thus indicating that the sample comprises both YICs just established and companies with some activities in place. The leverage ratio is also varying; we have companies with virtually no debt and companies that borrowed more consistently.[12] Not surprisingly, also the value of the return on assets ratio is dispersed, since both the operating margin and the total value of assets for many companies are very low, thus leading to very low or very high values of their performance ratios.

[Insert Table 3]

5. Empirical analysis

5.1 Main results

The results of the econometric analysis are exposed in Table 4.[13] In the upper part of the Table we analyse first transitions: in the first column the estimates are related to the firms' likelihood to access

[12] In some cases the value is larger than 1 because of the relevant losses carried forward by the companies, that sometimes exceed the book value of the equity capital.

[13] We have estimated the econometric models using OX Professional (Doornik, 1999).

VC investments (y^A) and in the second column estimates refer to YIC's access to GG bank loans (y^B). The lower part of the Table reports the results on the second transitions.

[Insert Table 4]

5.1.1 First transitions: segmentation vs similarity

Overall, the results point to the presence of relevant differences among YICs in terms of access to the two different financial sources and underlying policy interventions. In order to confirm the presence of segmentation between YICs, a series of specific *z-tests* was run between the coefficients of the two equations, with the aim to test their differences (Brame et al., 1998; Paternoster et al., 1998). The null hypothesis that the coefficient of a variable for the VC equation is equal to the corresponding coefficient of the same variable in the GG equation is rejected, at the 1% level, for almost all the firm-specific regressors. These results speak in favour once again of the *Task segmentation* hypothesis.

More specifically, beside the accumulation point at the founding year which is positive and significant for both typologies of subsidized financing forms (but stronger for GG bank loans, see the coefficients of the variable $Dseed_t$ and the related *z-test*), the estimated coefficient of Age_t is negative and statistically significant (at 1%) on the probability to access GG bank loans, while it turns out to be statistically negligible for what concerns the YIC's probability to access VC funds. Thus, the result highlights that GG bank loans show a relatively higher propensity than VC investments to flow towards very early stage companies. Similarly, $Employees_{t-1}$ has a negative and significant impact on the GG equation (at 5% level), while it turns positive but not statistically significant for the VC equation. In other words, small-sized YICs, in terms of employees, find easier access to GG bank loans than VC investments (notwithstanding the fiscal incentives at work). The results point to a sort of 'institutional division of labour' between the two policy measures under investigation.

But differences between the two estimated equations include also other determinants. $LnTotAsset_{t-1}$ has a positive impact on both subsidized VC investments and GG bank loans, but the coefficient is larger for the latter than for the former, their difference being statistically significant at

1% level. In this case, while both financing types do not appear to flow towards largely undercapitalized YICs, the result also suggests the relevance at the banks' eyes of the collateral value embodied in total assets for securing the loan (notwithstanding the presence of the partial government guarantee).

The variable $N\_Manager_t$ has a positive and statistically significant impact on VC financing (at 1%) but it is not statistically significant in the GG bank loans equation. These findings confirm the particular attention to the team and managerial professionalization paid by equity investors compared to bank lenders of the firm. Overall, the findings suggest that the two types of investors target different types of YICs.

The variables $Leverage_{t-1}$ has a negligible impact on both regressions, indicating the absence of any statistical connection between the likelihood to receive VC funds or GG bank loans and the YIC current financial structure. On the other side, the variable ROA_{t-1} has a negative impact both on VC (at 5%) and GG equations (at 10%). This evidence shows how the short-term return for early-stage startups is not considered a key decision driver for the investors; on the contrary, costs and investments are positively evaluated as to finance future growth and survival.

Regarding location-specific variables, the coefficient of the variable *DSouth* is statistically insignificant for both subsidized VC and GG bank loan equations. On the other side, the variables *Industrial Intensity* and *Value Added* exhibit a positive and significant impact on the YIC's probability to obtain a GG bank loan (respectively at 10% and 5% levels), while only *Value Added* has a positive and statistically significant effect for what concerns the probability to obtain a VC investment. Overall, there is no evidence that the two policy measures increased access to finance for YICs in less developed regions, compared to the rest of the country.

Interestingly enough since it points to a notable difference, while access by YICs to GG bank loans turns out to be pro-cyclical, the reverse applies to VC. In fact, both variables $Deficit/GDP_t$ and $GDPGrowth_t$ show a positive and significant impact (at 1% level) on the GG bank loans equation, while a negative impact of $GDPGrowth_t$ (statistically significant at 1% level) emerges in the VC regression.

Looking at the industry dummies, the higher probability to receive a VC investment has been for Software YICs, while firms active in Manufacturing showed a greater propensity to access GG bank loans than YICs active in other sectors.

5.1.2 Substitutability vs Complementarity

Results related to second transitions are displayed in the lower part of Table 4. While the coefficient β_A is positive but statistically negligible, the coefficient β_B is negative and statistically significant (at 5% level). This result points to the presence of a substitution effect: once backed by a VC, a YIC is less likely than before to access a GG bank loan. This result highlights how the investment in equity made by a VC reduces the likelihood by the startup to apply for a Government-guaranteed bank loan. Finally, simultaneous obtainment of both forms of financing is equally likely than obtaining each source of financing in isolation as testified by the large statistical insignificance of the parameter γ_0.

To sum up, what stands out from the empirical analysis is that the two policy measures sustain rather different typologies of YICs, with different characteristics. Once a YIC receives support from VC, this further decreases its likelihood to obtain GG bank loan. Thus, the picture that emerges is a kind of *Task segmentation* between the two policy measures. In the following we investigate whether this effect is robust to different model specifications and checks and provide additional evidence on the topic.

5.2 Robustness checks and augmented models

In order to gauge the robustness of our findings, we tested them by running distinct sub-sample analyses, adopting different specifications and implementing alternative methodologies. The results of *z-tests* in these new settings are very similar to the ones already exposed and overall they deliver the same picture.[14]

[14] The z-test results are available upon request.

5.2.1 Industry segmentation

Results from Table 4 highlights the presence of a *Task segmentation effect* between the different policy measures. In this section we explore whether industry heterogeneity may determine interesting differences and nuances to this global picture. In fact, strategies by innovative startups can be highly idiosyncratic with respect to the sector of operations and this may translate in different financing needs and opportunities for YICs operating in different industries (Hall et al., 2000; Johnsen and McMahon, 2005). Our enquire is to some extent limited by the small number of second transitions available (e.g. as reported in Table 1, only 48 out of 2,526 YICs have obtained both VCs and GG bank loans) which makes impossible the estimation of sector-specific dynamic bivariate survival models using a fine-grained industry classification. We tackle this limitation as follows. We re-aggregated the four-pronged industry classification used in the main analysis (i.e. Manufacturing, R&D, Software and General Services sectors) by forming two industry macro-categories, e.g. Manufacturing–R&D sector and Software–Services sector. Allegedly we run the dynamic bivariate survival model in the two sub-samples identified. Results of this analysis are reported in Table 5. Then, we also run a series of dynamic bivariate probit analyses in the four original industries to verify that first transitions did not greatly differ within each macro-category. Overall, apart from a loss of statistical significance of some coefficients, the picture of *Task segmentation effect* is confirmed and our further check did not reveal the presence of more dramatic cross-sectorial differences than those already highlighted in the previous Section.

Focusing on the most notable differences with the full sample, for the Software–Services sector sub-sample, the effect of the number of *Employees* at *t-1* on the probability to access GG bank loan is now statistically insignificant while it is negative and significant for the whole sample (at the 5% level, see Table 4) and for the Manufacturing-R&D sub-sample (at the 1% level). Moreover, while the coefficient of ROA_{t-1} is still negative in the VC equation for both the mentioned groups, it now turns out to be statistically negligible in the GG loan equation for the Software-Services sub-sample. Concerning the analysis of second transitions, the coefficient β_B, associated to the effect of previous

access to an equity investment on the access to a GG bank loan (*VC→ GG*), remains negative and statistically significant at 5% for the Services–Software sector sub-sample, while it remains negative but loses some statistical significance in the Manufacturing–R&D sub-sample.

Overall, the findings reveal the presence of some interesting nuances across different sectors. But these differences appear limited in numbers and, for what most matters from our perspective, these findings confirm the general picture and bring support to the *Task segmentation effect*.

[Insert Table 5]

5.2.2 Human capital variables

Starting from the original sample of 2,526 YICs and focusing on the sectors with the higher number of companies in the two macro-sector previously identified (i.e., the Software and Manufacturing industries), we also verified whether our findings were robust to an augmented model specification which also included independent variables capturing the human capital of the YICs' entrepreneurial teams. In fact, there is a conspicuous body of literature which highlights how entrepreneurs' human capital is usually an important driver of VCs' target choice (e.g. Muzyka et al., 1996; Zacharakis and Meyer, 2000; Baum and Silverman, 2004). We aim at verifying if the inclusion of these characteristics may change the findings already exposed and, eventually, in which direction they do so. To this extent, we were able to collect manually information on the educational background and work experience of 2,256 entrepreneurs of 1,072 YICs.[15] Data were retrieved by combining the use of the *Telemaco* database jointly with the professional social network LinkedIn through a Premium access.[16] The human capital data are related to the education and work experience of entrepreneurs. More specifically, the former includes information about the education degrees (bachelor, master and PhD) and the study

[15] χ2 tests show that there are no statistically significant differences between the distribution of this sample of 1,072 YICs and the corresponding distributions of the population of the large sample from which it was drawn. In particular, the small one is very similar to the large one under all the financials indicators/company characteristics and presence of external investors. Results are available upon request from the authors.

[16] The use of information in scientific studies gathered from professional social networks like LinkedIn is increasingly used as in general (Gloor et al., 2011; Weber and Jung, 2015) as with specific reference to the entrepreneurship literature (De Cleyn et al., 2015; Giudici et al., 2018).

fields (technical/scientific or economic). The latter includes information about the generic pre-entry work experience of the entrepreneur, the pre-entry work experience that each entrepreneur gained in the sector of operation of the startup and the pre-entry managerial experience. More specifically, *Economic Education* is the average of the number of years of the founders' economic and/or managerial education at graduate and post-graduate level. *Technical Education* is the corresponding variable in terms of scientific and/or technical subjects. *Managerial Experience* measures the average number of years of the entrepreneurs' managerial pre-entry professional experience. *Sector Work Experience* and *Generic Work Experience* measure the average years of founders' work experience in the same sector and in other sectors of the startup before foundation, respectively. Definition of these variables and their descriptive statistics are provided in the dedicated Appendix (see Table A2 and Table A3).

We run the main econometric model with an augmented specification including these variables and the results are exposed in Table 6. Notably, entrepreneurs' human capital is found to scarcely affect YIC's access to (subsidized) VC, where only *Managerial Experience* is found to positively and significantly (at 5% level) impact the YIC's probability to obtain an equity investment. Other results related to the first transitions in the VC equation are rather similar to those exposed in Table 4. Looking at the GG bank loan equation, interesting results characterize the variables *Economic Education, Sector Work Experience* and *Generic Work Experience*. They show negative and significant (respectively at the 10% level only for the former two and at the 5% for the latter) coefficients. As described in the existing literature, our results confirm the secondary importance of the entrepreneurial team to the bankers, highlighting that the lending decisions are dominated by financial factors. Considering that the characteristics of the founding team are an important determinant of YIC assets, we interpret the results as another evidence in favour of segmentation of YICs for what concerns the two type of investors (and the two underlying policy mechanisms). Considering the control variables, macro-economic specific determinants lose significance in the GG loan equation; the number of managers becomes positively correlated, and the location in the South

of Italy negatively correlated, but the significance levels are very low (10%). The return on assets turns to be insignificant.

As to the second transitions, it is quite interesting to observe that the coefficient β_B is still negative and statistically significant (at 5% level) as in Table 4. In other words, it is reinforced the result that once received a VC investment, a YIC becomes even less likely than before to access the other form of subsidized financing, i.e. GG bank loans.

[Insert Table 6]

5.2.3 Local entrepreneurial and financial eco-system

In order to better investigate the effects of the specific geographical location on YICs' probability to access the two financing mechanisms, we also enlarged our model specification by adding two specific geographical-related covariates, *Incubators* and *VC Investment*$_{t-1}$. The former is the number of incubators and permanent accelerator programs (source: Italian Chambers of Commerce) existing at regional level (NUTS2), where we distinguish the number of those active before and after 2012; the latter is the lagged total amount of VC investments per region per year (source: AIFI, the Italian Association of Private Equity and Venture Capital investors). Business incubators constitute a specific institution designed to support new ventures by providing to the tenant companies several facilities, from workspace to management and knowledge support (Colombo and Delmastro, 2002; Peters et al., 2004; Aerts at al., 2007). Then, VCs are 'local' investors, in the sense that most investees are often located nearby VCs' headquarters (Gompers and Lerner, 2004; VICO, 2011; Lutz et al., 2013). Therefore, both variables capture two salient characteristics of the entrepreneurial ecosystem in which YICs operate that may interfere with the investigated dynamics. The results are reported in Table 7. The coefficient of *Incubators* is found to be positive and significantly correlated with the access to subsidized VC investments. The result highlights that incubators may ease the information flow and create direct connections between YICs and investors. They are often considered as a source of deal flow from venture capitalists and business angels (Gompers and Lerner, 2004).

Surprisingly the coefficient of *VC Investment*$_{t-1}$ is negative (at the 5% level) in the VC equation. The evidence may be interpretable through a 'saturation' effect: in thin markets, if the demand for capital at the local level is given, an investment from venture capitalists will reduce the probability of new deals in the following year in the same region (for similar findings in the Italian context see Bertoni et al., 2018). Another possible explanation could be the VCs' objective to diversify investment risks throughout different regions.

The coefficients of *Incubators* and *VC Investment*$_{t-1}$ are found to be statistically insignificant in the GG bank loan equation; the vivacity of the local startup and venture capital ecosystem does not seem to influence bank borrowing. Looking at the second transitions, the results confirm the evidence highlighted in Table 4, confirming the presence of a *Task segmentation effect*. The significance of the coefficients of the other variables are virtually unchanged, compared to Table 4.

[Insert Table 7]

5.2.4 Lagged variables

Additionally, we addressed the possible concern that the information loss associated with the use of lagged independent variables, despite their operationalization through Equation (1) and the multiplication with (1-*Dseed*$_{it}$), could undermine the explanatory power of such covariates. To this purpose, we run again the model by using all time-varying covariates at year *t*. Results are exposed in Table 8.

[Insert Table 8]

The most sensitive change respect to the results shown in Table 4 involves the *Employees*$_t$ variable. Using the total amount of employees per company in the same year of analysis, the coefficient becomes statistical insignificant in the GG bank loans equation. But apart from this change, no major modifications are brought to our findings.

5.2.5 Seemingly unrelated bivariate probit model

Finally, we also used one alternative methodology, specifically a seemingly unrelated bivariate probit model, in order to further assess the strength of our findings (Mina et al., 2013). Compared to

the dynamic bivariate survival model, this approach has been originally intended to analyse static processes.

As shown in Table 9, the results are similar to those highlighted in the previous sets of regressions and, above all, they confirm the *Task segmentation effect*.[17] Furthermore, the results highlight that the correlation coefficient between the error terms of the two equations is not statistically significant (looking at the bivariate probit regression, ρ is equal to 0.089, chi-square(1) = 1.020, p-value = 0.3124), highlighting that non-modelled unobserved heterogeneity does not seem to interfere significantly with the investigated dynamics.

[Insert Table 9]

5.3 Additional evidence

Finally, having proved the robustness of our findings related to the *Task segmentation effect*, we hereby briefly explore two interesting aspects related to the dynamics at stake.[18]

First, we investigate which characteristics of banks and VCs are associated to a greater attitude in taking advantage of the underlying policy mechanisms and provide funds to YICs, and in particular we explore whether larger financial operators were more prone than smaller ones. To this purpose, a new hand-collected longitudinal database has been built, starting from the list of banks and professional venture capitalists that invested in the YICs included in our dataset. We have thus identified 101 banks and 116 VCs and for all of them we have manually counted the total annual number of *i*) loans granted through the GG measure (418) and *ii)* VC investments (276), during the sample period (see Table 10).

[Insert Table 10]

[17] We also checked through a series of Wald tests the null hypothesis of equality of the coefficients of each independent variable across the two equations of the seemingly unrelated bivariate probit model by adapting the procedure reported in Gimmon and Levie (2010).The results are totally in line with the z-tests run for the dynamic bivariate survival model (see Table 4), and they further reinforce the *Task segmentation effect*: we can now reject the null hypothesis of equality also for the coefficients associated with the variables $Leverage_{t-1}$ and ROA_{t-1} at the 1% level, and for *Infrastructure* and *R&D sector* at the 5% level (results are available upon request).

[18] We thank an anonymous reviewer for raising these interesting issues.

We introduce two variables called respectively, $Loans_t$ and $VC\ Investments_t$, namely the number of GG loans and equity investments made by the investors, during year *t*. In our regression the independent variables are (i) the bank size, measured by the logarithm of consolidated total assets at the beginning of year *t*, i.e. $LnConsAsset_t$ (Source: MBRES – Ufficio Studi Mediobanca S.p.A.); (ii) the VC fund size, measured by the log of the assets under management at the beginning of year *t* $LnAUM_t$ (Source: CrunchBase, VCs' balance sheets and websites). Then, we include different control variables in the two equations. For what concerns banks, the dummy variable *International Branch* takes value 1 for foreign banks which have a branch in Italy. Foreign banks could be driven by different objectives, compared to national incumbents, or could rely on the experience built in more important markets, like the US or UK (Giudici and Roosenboom, 2004). In the same vein, *Local Bank* is a dummy variable that identifies regional banks (that could benefit from lower information asymmetry and proximity with the YIC; see Binks and Ennew, 1997) and finally, the dummy *Startup Program* is equal to 1 if the bank runs a specific startup acceleration program. Turning to the VC equation, we include the dummy variable *Foreign Headquarter* which takes the value of 1 for foreign VC investors. We run random effects panel data regressions whose results are exposed in Table 11. The results were also corroborated and largely confirmed by two further analyses: a) the use of weights to check whether the unbalanced nature of the dataset could drive some findings; b) an OLS cross-sectional analysis limited at one single year (2016), where the two dependent variables have been defined as the cumulated sum of deals over time, from 2009. We see that larger banks have been more eager to invest in YICs, while conversely there is no 'size effect' for what concerns VCs. Interestingly, the coefficient of the *Startup Program* variable is found to be positive and statistically significant (at 1%) on the number of granted loans, pointing to the fact that credit backed by government guarantees is more likely to be granted by banks institutionally oriented towards the financing of YICs. As to the international breadth of operations, this does not seem to greatly affect either the number of loans granted or VC investments. In particular, controlling for the size of the VC, foreign affiliated VCs have *ceteris paribus* contributed less than the Italian counterparts to the 276 sample VC deals (as a matter

of fact we counted 30 foreign VCs out of 116, which implemented 41 out of the 276 investments tracked in this research).

[Insert Table 11]

As a second interesting aspect, we explore how the two (policy subsidized) financial measures have impacted YICs' operating performance. Relying on an extensive literature on entrepreneurial performances (Delmar et al., 2003), we focused on both sales and employees growth dynamics. Specifically, we collected such data (source: AIDA - Bureau van Dijk) all over the available time-span (2009-2016), and, taking advantage of the (unbalanced) panel-data structure of our dataset, we built at the company-level two performance variables: a) $LnSales_{it}$ which is the logarithm of the total annual sales of firm *i* during year *t*[19] and b) $TotEmployees_{it}$, the number of employees reported by firm *i* at the end of year *t*. Following the consolidated empirical literature on startup performances (e.g. Colombo and Grilli, 2005; 2010), "the vector of independent variables includes the age of the firm, thus to make the dependent variable an indicator of the average yearly absolute [sales or employees] growth in the period in which a firm is observed" (Colombo and Grilli, 2005, pp. 804-805). Since the aim of the analysis is to ascertain the effect of the (policy subsidized) external financial resources on firms' performance, two time-varying step dummies are included as main independent variables: lagged venture capital investment, VC_{t-1}, and lagged access to a Government- guaranteed bank loan, GG_{t-1}. The binary variables are equal to 1 if the sample YIC *i* received venture capital financing, or alternatively a GG bank loan, during year *t*. The model specification is completed by a series of control variables already defined in Table 2. We run this performance analysis using a panel data random effects model. Results are presented in Table 12. They highlight that VC is undoubtedly a driver of growth performances (both in terms of sales and employees), in line with the most recent empirical literature in the field (e.g. Bertoni et al., 2011; Grilli and Murtinu, 2014); while the effect of GG bank loans is positive and statistically significant only for what concerns employee growth and it is less neat

[19] The logarithmic transformation of sales is generally used in studies on firm growth to take into account possible outliers. It is worthwhile to note that in our case this choice does not sensibly affect the results.

from a statistical point of view for what concerns sales. This analysis was corroborated by further checks. In particular, results are unchanged once performance variables in levels are transformed in logarithmic growth variables and when a dynamic specification is used and the resulting model estimated through a GMM-SYS estimator, which takes into account the endogenous nature of the lagged dependent variable and (potentially) of the two main independent variables of interest, i.e. VC_{it-1}, and GG_{it-1}. Despite of the fact that all these analyses point to the same direction, we still deem this investigation as only short-term oriented, given the unavoidable limited distance in time eventually occurring between investments and performances.[20]

[Insert Table 12]

6. Discussion and conclusions

6.1 Summary of results

Both academic scholars and policy makers agree on the importance for an economic system to nurture the creation and sustainment of young innovative companies (YICs) and startups. YICs are deemed to be capable to challenge existing technological paradigms and to ensure a high degree of dynamic efficiency in modern economies. Accordingly, they are increasingly becoming a specific object of study for academics (see Schneider and Veugelers, 2010; Czarnitzki and Delanote, 2013) and an explicit target for industrial policies by policy makers, especially in the European context (see for EC-DG ENTR, 2009, for an overview). This typology of firm is in fact reputed to suffer from important capital market imperfections (see Carpenter and Petersen, 2002) which may prevent YICs from exerting their beneficial effects into markets. Thus, while general consensus exists on the need for public intervention devoted to alleviating YICs' financial constraints, much less agreement is traceable on the most effective policy mechanisms that are capable to accomplish the task. Following the

[20] Therefore, while acknowledging the interest of these preliminary findings, at the same time we recommend caution in their emphasis. Future research endeavours will be needed in this respect by embracing a longer time perspective as soon as the accounting data of the sample YICs will be released in the future.

entrepreneurial finance theory, venture capital (VC) investors are considered the preferred financing mode for this typology of firms (Gompers and Lerner, 2001; Carpenter and Petersen, 2002). Conversely, contrary to the conventional wisdom, other studies argue that young and risky new ventures may choose debt contracts instead of equity since hazardous but large returns are of relatively more value for a loan-financed firm (Schäfer et al., 2004).

Several recent studies have analysed, especially from the perspective of the demand for outside finance, the way to foster investments for young and innovative companies but it remains rather underexplored the evaluation of possible interdependencies with different policy measures aiming at easing YIC's access to external financing sources.

This study exploits the Italian Startup Act (Law no. 221/2012) to shed light on this key issue. In this case, in fact, YICs are equally exposed *at the same time* and *in the same institutional context* to two specific policy measures which aim at alleviating their financial constraints. The first measure envisages fiscal incentives for equity investors (i.e. venture capital), while the second gives privileged access for YICs to a Government-guaranteed (GG) bank loan program. Therefore, through the collection of a hand-collected dataset on 2,526 Italian YICs and the means of a dynamic bivariate survival model (Mosconi and Seri, 2006), we first investigate whether firms accessing one instrument differ along a series of characteristics from counterparts accessing the other one. Secondly, we dig into the mutual interrelationships existing between the two policy measures. Our first important result is that the two mechanisms appear to be functional to different typologies of YICs. Specifically, YICs obtaining GG bank loans appear relatively younger, are managed by less executives and employ less people than those YICs invested by (subsidized) VC. The latter are endowed with a lower asset value, and are more active in the Software business (and less in Manufacturing). In other words, a sort of 'institutional division of labour' seems to be in place between the two measures, with each instrument financing a given typology of YIC. As expected, in their investment conducts VCs appear to diverge substantially from bankers, and the policy intervention does not change radically the selection process. Secondly, once received support from one measure, a clear substitutability effect emerge

towards the other instrument. There is a statistically significant evidence that once received a VC investment, a YIC becomes even less likely than before to access a GG bank loan. In that respect, our findings support a *Task Segmentation effect* between the two policy mechanisms: they target (and serve the needs) of different YICs, and once obtained a type of financing is unlikely that the supported firms will access the other form.

6.2 Future researches and data limitations

Some unavoidable limitations of our study open interesting avenues for future research. First, whether the 'equilibrium' between subsidized VC investments and access to GG bank loans is the result of more demand- rather than supply-side forces is hard to say on *a priori* ground and requires further research endeavours. Second, the covered period of analysis is relatively limited and the results are likely to be more informative about the short-term rather than the long-term effects of the policy intervention. In particular, data over a longer period would permit to assess a more comprehensive evaluation of the policy at the industry level. In relation to the results reported in Section 5.3.1, industry related factors such as capital intensity, technology intensity and failure risks could influence the effect of the policy intervention on the collection of external financial resources by YICs. Third, while it is quite clear that the policy intervention has been effective on the likelihood to obtain external funds and that these funds enhanced YICs' short-term performance, a longer perspective than what was possible to adopt here is needed to gauge the impact of the specific subsidized financing modes on YICs' long-term performance.

6.3 Policy implications

The findings of our study have interesting implications in the realm of the government's role in the entrepreneurial finance market, and on the preferable ways of public activity in the domain of young innovative companies.

First of all, they highlight how a comprehensive policy mechanism, such as the Italian Startup Act, that encompasses different instruments for the subsidization of both debt and equity of the innovative startups does not present serious cannibalization risks and crowding-out effects. Fiscal deductions for

equity investments and Government-guaranteed bank loan funds flow towards different types of young innovative companies.

Second, they show that the policy entails a significant reduction for bankers of the negative effects deriving from information asymmetry. As Berger and Udell (1998) pointed out, the main concern for investments in young companies is linked to information asymmetry faced by investors and the risk associated with it (see also Jensen and Meckling, 1976). The Government-guaranteed fund (GG) involves a reduction of the effects of type 1 risk (lending to failure business) for the banks, encouraging them to grant loans also to the younger and smaller YICs. On the opposite side, the fiscal reduction envisaged for equity investments did not seem to have produced shifts on the characteristics of VC targets, but, at the same time, surely contributed to increasing the number of VC investments in the thin Italian VC market (Bertoni et al., 2018). Given the importance that is associated to VC as an external financing resource (Carpenter and Petersen, 2002; Ueda, 2004), and the historical weaknesses experienced in continental Europe to make flourish the VC market (Cosh et al., 2009; Grilli and Murtinu, 2014), this vertical tax-cut type of policy does seem to represent one of the few available policy mechanisms capable to effectively nurture VC in Europe (for similar findings at the European level, while starting from different premises and approaches, see also Henrekson and Sanandaji, 2018 and Grilli et al., 2018b).

Third, on the other side of the token, our analysis clearly shows how policy complementarities (Rodrik, 1996) in the domain of financial support to innovative entrepreneurship are difficult to achieve. Indeed, this may simply depend on a mere saturation effect on the demand-side, which is not necessarily negative from a social welfare point of view. But it remains that the absence of strong synergies between the two policy mechanisms is also probably revealing the irrelevance of “stamp of approval” phenomena (Lerner, 2002, p. F78) running among the different (subsidized) financial operators.

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Tables and Figures

Figure 1 Taxonomy of the different scenarios about the policy effect on YICs of tax benefits on equity investment and government guarantees on bank loans

Interrelationships between policy intervention **Type of YICs**	*Substitutability*	*Complementarity*
Same	**Shadow effect**	**Matthew effect**
Diverse	**Task segmentation effect**	**Halo effect**

Figure 2 State-transition diagram for the dynamic bivariate survival model

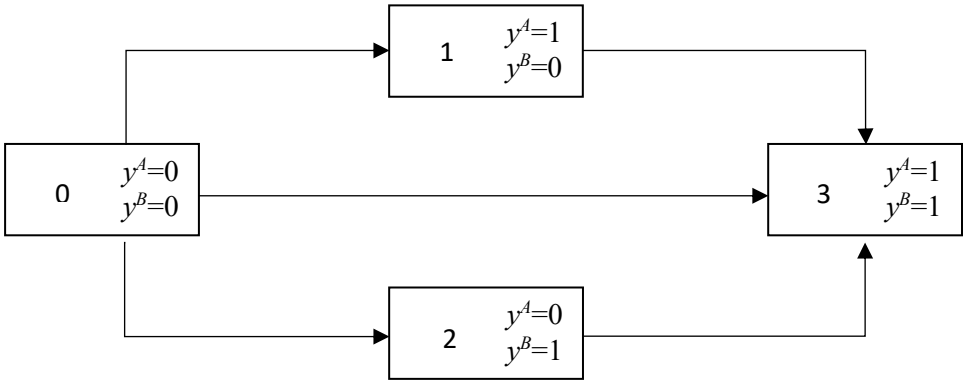

Table 1 VC-backed YICs and YICs accessing the Government-guaranteed (GG) bank loans program

	Financed YICs	
Financing source (observation period from 2009 to 2016)	N°	%
YICs invested by VC	276	10.9
YICs financed by GG bank loan	418	16.6
YICs financed by VC and GG bank loan	48	1.9
Second transitions (observation period from 2009 to 2016)	N°	%
Transition: from VC → VC + GG bank loan	29	60.4
Transition: from GG bank loan → GG bank loan + VC	7	14.6
Transition: from nothing → GG bank loan + VC in the same year	12	25.0

Legend: Percentages on the Financing sources (upper part) are computed with reference to the whole sample (2,526 firms). Percentages on second transitions refer to the 48 YICs that received both types of financing.

Table 2 Definition and source of explanatory variables

Variable	Vector	Description
Firm-specific		
Dseed$_t$		Dummy equal to 1 if *t* is the firm's foundation year, zero otherwise
Age$_t$	z_{it}^j	Age of the firm at *t* (source: *AIDA*)
N_Manager$_t$	z_{it}^j	Number of managers at *t* (source: *AIDA*)
Employees$_{t-1}$	k_{it-1}^j	Number of employees at *t-1* (source: *AIDA*)
LnTotAsset$_{t-1}$	k_{it-1}^j	Natural logarithm of absolute value of firm total assets at *t-1* (source: *AIDA*)
Leverage$_{t-1}$	k_{it-1}^j	Ratio between financial debt at time *t* and total assets at *t-1* (source: *AIDA*)
ROA$_{t-1}$	k_{it-1}^j	Gross operating margin compared to the total assets at *t-1* (source: *AIDA*)
Location-specific		
DSouth	z_{it}^j	Dummy for firms located in the South of Italy (1 if they are located in the South, zero otherwise)
Industrial Intensity	z_{it}^j	Regional Industrial intensity where the startup headquarter is located (Number of firms/100 residents, reference year: 2012, sources: *ISTAT, Istituto G. Tagliacarne*, *InfoCamere*)
Value Added	z_{it}^j	Regional incidence on the Italian value added, in percentage terms (reference year 2011, sources: *ISTAT, Istituto G. Tagliacarne*, *InfoCamere*)
Infrastructure	z_{it}^j	Regional infrastructure and economic indicator where the startup headquarter is located (reference year: 2011, sources: *ISTAT, Istituto G. Tagliacarne*, *InfoCamere)*
Macroeconomic-specific		
Deficit/GDP$_t$	z_{it}^j	Italian budget deficit compared to the national GDP at current market prices at *t* (source: *EUROSTAT*)
GDPGrowth$_t$	z_{it}^j	Italian real GDP growth rate at *t* (source: *EUROSTAT*)
Sector-specific		
Manufacturing sector	z_{it}^j	Dummy equal to 1 for companies classified in Manufacturing sector (source: *AIDA*)
R&D sector	z_{it}^j	Dummy equal to 1 for companies classified in R&D sector (source: *AIDA*)
Software sector	z_{it}^j	Dummy equal to 1 for companies classified in Software sector (source: *AIDA*)
General Services sector		Dummy equal to 1 for companies classified in general Services sector (source: *AIDA*)

Table 3 Descriptive statistics for the explanatory variables in the econometric model

Variable	Mean	Stand. Dev.	Max	Min
Age_t	2.752	1.454	9.000	1.000
$N\_Manager_t$	2.538	1.854	13.000	0.000
$Employees_{t-1}$	0.790	2.463	50.000	0.000
$LnTotAsset_{t-1}$	7.703	5.357	16.380	0.000
$Leverage_{t-1}$	1.043	1.021	5.889	0.000
ROA_{t-1}	-0.094	0.465	1.799	-5.500
DSouth	0.186	0.389	1.000	0.000
Industrial Intensity	8.950	0.718	10.200	7.570
Value Added	9.387	6.889	21.290	0.280
Infrastructure	106.927	29.142	220.230	37.900
$Deficit/GDP_t$	-2.916	0.310	-2.600	-4.200
$GDPGrowth_t$	-0.316	1.336	1.700	-2.800
Manufacturing sector	0.207	0.405	1.000	0.000
R&D sector	0.175	0.380	1.000	0.000
Software sector	0.392	0.488	1.000	0.000
General Services sector	0.223	0.416	1.000	0.000

Legend: Sample: 2,526 firms. Number of observations: 8,093. In particular, 5493 observations in the Manufacturing sector, 442 in the R&D sector, 1035 in the Software sector and 556 in the General Services sector.

Table 4 Determinants of YICs' access to Venture Capital (VC) and Government-guaranteed (GG) bank loans: dynamic bivariate survival model

	First Transitions	Venture Capital (y^A)	GG bank loan (y^B)
α_{const}	*Constant*	-4.157 (0.7253)***	-3.210 (0.2450)***
	$DSeed_t$	1.589 (0.3901)***	3.003 (0.3001)***
α_1	Age_t	-0.031 (0.0355)	-0.117 (0.0254)***
β_1	$Employees_{t-1}$	0.012 (0.0123)	-0.031 (0.0126)**
β_2	$LnTotAsset_{t-1}$	0.123 (0.0356)***	0.265 (0.0267)***
α_2	$N\_Manager_t$	0.172 (0.0156)***	0.017 (0.0148)
β_3	$Leverage_{t-1}$	-0.051 (0.0485)	0.009 (0.0308)
β_4	ROA_{t-1}	-0.255 (0.1034)**	-0.165 (0.0902)*
α_3	*DSouth*	0.123 (0.1248)	-0.022 (0.0898)
α_4	*Industrial Intensity*	-0.046 (0.0603)	0.063 (0.0352)*
α_5	*Value Added*	0.010 (0.0060)*	0.011 (0.0044)**
α_6	*Infrastructure*	0.000 (0.0014)	0.000 (0.0010)
α_7	$Deficit/GDP_t$	-0.164 (0.1094)	0.690 (0.0999)***
α_8	$GDPGrowth_t$	-0.074 (0.0256)***	0.257 (0.0262)***
α_9	*Manufacturing sector*	0.002 (0.106)	0.424 (0.0799)***
α_{10}	*R&D sector*	-0.180 (0.1209)	0.094 (0.0894)
α_{11}	*Software sector*	0.345 (0.0864)***	0.102 (0.0755)
	Second Transitions		
β_A	$GG \rightarrow VC$	0.238 (0.2047)	-
β_B	$VC \rightarrow GG$	-	-0.269 (0.1222)**
	Simultaneity		
γ_0	$0 \rightarrow VC+GG$	0.055 (0.1484)	

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,526 and number of observations is 8,093.
Indicates that the coefficients are significantly different at p < .05 (two-tailed *z*-tests).

Table 5 Determinants of YICs' access to Venture Capital (VC) and Government-guaranteed (GG) bank loans: dynamic bivariate survival model: Industry sector analysis

		Manufacturing-R&D sector		Software-Services sector	
	First Transitions	Venture Capital (y^A)	GG bank loan (y^B)	Venture Capital (y^A)	GG bank loan (y^B)
α_{const}	*Constant*	-7.699 (1.6680)***	-3.061 (0.3301)***	-3.500 (0.4522)***	-3.383 (0.3885)***
	$DSeed_t$	2.750 (0.7566)***	3.471 (0.4400)***	1.585 (0.4583)***	2.928 (0.4177)***
α_1	Age_t	-0.047 (0.0643)	-0.094 (0.0370)**	-0.029 (0.0417)	-0.148 (0.0350)***
β_1	$Employees_{t-1}$	0.005 (0.0255)	-0.072 (0.0257)***	0.012 (0.0141)	-0.019 (0.0149)
β_2	$LnTotAsset_{t-1}$	0.230 (0.0653)***	0.290 (0.0386)***	0.119 (0.0421)***	0.275 (0.0374)***
α_2	$N\_Manager_t$	0.159 (0.0272)***	0.025 (0.0209)	0.183 (0.0189)***	0.005 (0.0211)
β_3	$Leverage_{t-1}$	-0.129 (0.0854)	0.039 (0.0446)	-0.038 (0.0576)	0.003 (0.0417)
β_4	ROA_{t-1}	-0.663 (0.2062)***	-0.388 (0.1634)**	-0.233 (0.1129)**	-0.120 (0.1081)
α_3	*DSouth*	0.204 (0.2323)	-0.159 (0.1340)	0.173 (0.1334)	0.060 (0.1250)
α_4	*Industrial Intensity*	0.123 (0.1164)	0.050 (0.0480)	-0.052 (0.05801)	0.076 (0.0528)
α_5	*Value Added*	0.010 (0.0117)	0.015 (0.0063)**	0.012 (0.0066)*	0.007 (0.0063)
α_6	*Infrastructure*	0.001 (0.0025)	-0.001 (0.0015)	0.000 (0.00154)	0.001 (0.0014)
α_7	$Deficit/GDP_t$	-0.400 (0.1896)**	0.701 (0.1378)***	-0.019 (0.1326)	0.669 (0.1476)***
α_8	$GDPGrowth_t$	-0.075 (0.0484)	0.226 (0.0365)***	-0.063 (0.0301)**	0.281 (0.0383)***
	Second Transitions				
β_A	$GG \rightarrow VC$	0.559 (0.5905)	-	-0.100 (0.3167)	-
β_B	$VC \rightarrow GG$	-	-0.225 (0.2905)	-	-0.284 (0.1561)**
	Simultaneity				
γ_0	$0 \rightarrow VC+GG$	0.299 (0.2304)		-0.101 (0.1963)	

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 935 for Manufacturing-R&D sector and number of observations is 3,095; number of firms is 1,591 for Software-Services and number of observations is 4,998.

Table 6 Determinants of YICs' access to Venture Capital (VC) and Government-guaranteed (GG) bank loans: augmented dynamic bivariate survival model (with human capital variables)

		Model	
	First Transitions	Venture Capital (y^A)	GG bank loan (y^B)
α_{const}	*Constant*	-4.100 (0.7100)***	-2.957 (0.2632)***
	$DSeed_t$	1.588 (0.5286)***	3.136 (0.3763)***
α_1	Age_t	-0.043 (0.0486)	-0.076 (0.0335)**
β_1	$Employees_{t-1}$	0.007 (0.0140)	-0.027 (0.0147)*
β_2	$LnTotAsset_{t-1}$	0.118 (0.0465)**	0.267 (0.0321)***
α_2	$N\_Manager_t$	0.165 (0.0219)***	0.038 (0.0197)*
β_3	$Leverage_{t-1}$	-0.054 (0.0679)	0.031 (0.0428)
β_4	ROA_{t-1}	-0.320 (0.1159)***	-0.146 (0.1093)
α_3	*DSouth*	0.189 (0.1302)	-0.208 (0.1187)*
α_4	*Industrial Intensity*	-0.031 (0.0385)	0.037 (0.0301)
α_5	*Value Added*	-0.003 (0.0070)	0.008 (0.0056)
α_6	*Infrastructure*	0.001 (0.0015)	0.000 (0.0012)
α_7	$Deficit/GDP_t$	-0.132 (0.1477)	0.619 (0.1168)***
α_8	$GDPGrowth_t$	-0.110 (0.0346)***	0.225 (0.0328)***
α_9	*Software sector*	0.630 (0.1112)***	-0.031 (0.1154)
α_{10}	*Technical Education*	0.024 (0.0162)	0.023 (0.0154)
α_{11}	*Economic Education*	-0.005 (0.0039)	-0.006 (0.0037)*
α_{12}	*Managerial Experience*	0.013 (0.0062)**	0.008 (0.0061)
α_{13}	*Sector Work Experience*	-0.009 (0.0116)	-0.021 (0.0110)*
α_{14}	*Generic Work Experience*	-0.005 (0.0145)	-0.030 (0.0149)**
	Second Transitions		
β_A	$GG \rightarrow VC$	0.286 (0.2582)	-
β_B	$VC \rightarrow GG$	-	-0.356 (0.147)**
	Simultaneity		
γ_0	$0 \rightarrow VC+GG$	0.013 (0.193)	

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 1,072 and n° of observations is 3,665.

Table 7 Determinants of YICs' access to Venture Capital (VC) and Government-guaranteed (GG) bank loans: dynamic bivariate survival model. Estimation with two additional variables: number of incubators and total amount of VC investment per region (NUTS2 level)

		Model	
	First Transitions	Venture Capital (y^A)	GG bank loan (y^B)
α_{const}	*Constant*	-4.418 (0.8708)***	-3.226 (0.2509)***
	$DSeed_t$	1.497 (0.3985)***	2.960 (0.3034)***
α_1	Age_t	-0.033 (0.0357)	-0.119 (0.0254)***
β_1	$Employees_{t-1}$	0.009 (0.0126)	-0.031 (0.0126)**
β_2	$LnTotAsset_{t-1}$	0.128 (0.0364)***	0.265 (0.0267)***
α_2	$N\_Manager_t$	0.172 (0.0156)***	0.017 (0.0148)
β_3	$Leverage_{t-1}$	-0.050 (0.0486)	0.009 (0.0308)
β_4	ROA_{t-1}	-0.272 (0.1010)***	-0.165 (0.0901)*
α_3	*DSouth*	0.159 (0.1349)	-0.011 (0.0907)
α_4	*Industrial Intensity*	-0.044 (0.0675)	0.061 (0.0355)*
α_5	*Value Added*	0.019 (0.0073)***	0.014 (0.0062)**
α_6	*Infrastructure*	0.001 (0.0015)	0.000 (0.0010)
α_7	$Deficit/GDP_t$	-0.182 (0.1123)	0.689 (0.1005)***
α_8	$GDPGrowth_t$	-0.072 (0.0258)***	0.258 (0.0264)***
α_9	*Manufacturing sector*	0.019 (0.1068)	0.425 (0.0799)***
α_{10}	*R&D sector*	-0.177 (0.1215)	0.091 (0.0895)
α_{11}	*Software sector*	0.347 (0.0871)***	0.099 (0.0756)
α_{12}	*Incubators*	0.034 (0.0130)***	0.015 (0.0120)
β_5	$VC\ Investment_{t-1}$	-0.004 (0.0017)**	0.001 (0.0013)
	Second Transitions		
β_A	$GG \rightarrow VC$	0.261 (0.205)	-
β_B	$VC \rightarrow GG$	-	-0.269 (0.1224)**
	Simultaneity		
γ_0	$0 \rightarrow VC+GG$	0.060 (0.1490)	

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,526 and number of observations is 8,093.

Table 8 Determinants of YICs' access to Venture Capital (VC) and Government-guaranteed (GG) bank loans: dynamic bivariate survival model. Estimation with no lagged independent variables in the first transitions

		Model	
	First Transitions	Venture Capital (y^A)	GG bank loan (y^B)
α_{const}	*Constant*	-6.927 (1.0467)***	-3.333 (0.2909)***
	$Dseed_t$	0.480 (0.1084)***	0.257 (0.0914)***
α_1	Age_t	-0.061 (0.0375)	-0.117 (0.0266)***
α_2	$Employees_t$	-0.011 (0.0097)	-0.008 (0.0079)
α_3	$LnTotAsset_t$	0.401 (0.0321)***	0.294 (0.0255)***
α_4	$N\_Manager_t$	0.106 (0.0180)***	0.003 (0.0164)
α_5	$Leverage_t$	-0.370 (0.0476)***	0.169 (0.0244)***
α_6	ROA_t	-0.565 (0.0646)***	-0.262 (0.0735)***
α_7	*DSouth*	0.201 (0.1513)	-0.143 (0.1026)
α_8	*Industrial Intensity*	-0.038 (0.0793)	0.031 (0.0381)
α_9	*Value Added*	0.004 (0.0073)	0.005 (0.0047)
α_{10}	*Infrastructure*	0.001 (0.0016)	-0.000 (0.0011)
α_{11}	$Deficit/GDP_t$	-0.097 (0.1293)	0.740 (0.1095)***
α_{12}	$GDPGrowth_t$	-0.067 (0.0291)**	0.256 (0.0279)***
α_{13}	*Manufacturing sector*	-0.069 (0.1214)	0.303 (0.0887)***
α_{14}	*R&D sector*	-0.214 (0.1380)	0.161 (0.0968)
α_{15}	*Software sector*	0.368 (0.1004)***	0.101 (0.0832)
	Second Transitions		
β_A	$GG \rightarrow VC$	0.360 (0.2264)	-
β_B	$VC \rightarrow GG$	-	-0.289 (0.1274)**
	Simultaneity		
γ_0	$0 \rightarrow VC+GG$	0.095 (0.1618)	

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,526 and number of observations is 8,093.

Table 9 Determinants of YICs' access to Venture Capital (VC) and Government-guaranteed (GG) bank loans: seemingly unrelated bivariate probit model

		Model	
	First Transitions	Venture Capital (y^A)	GG bank loan (y^B)
α_{const}	*Constant*	-4.870 (0.7433)***	0.286 (0.6961)
	$Dseed_t$	3.785 (0.2880)***	3.115 (0.2880)***
α_1	Age_t	-0.026 (0.0241)	-0.156 (0.0228)***
β_1	$Employees_{t-1}$	-0.003 (0.0086)	-0.020 (0.0102)**
β_2	$LnTotasset_{t-1}$	0.370 (0.0253)***	0.273 (0.0259)***
α_2	$N\_Manager_t$	0.181 (0.0123)***	0.035 (0.0140)**
β_3	$Leverage_{t-1}$	-0.263 (0.0348)***	0.073 (0.0265)***
β_4	ROA_{t-1}	-0.697 (0.0614)***	-0.251 (0.0818)***
α_3	*DSouth*	0.117 (0.1060)	-0.375 (0.1031)***
α_4	*Industrial Intensity*	-0.139 (0.0553)**	-0.125 (0.0508)**
α_5	*Value Added*	0.003 (0.0049)	-0.002 (0.0046)
α_6	*Infrastructure*	0.000 (0.0012)	-0.003 (0.0011)**
α_7	$Deficit/GDP_t$	0.043 (0.0957)	1.136 (0.1167)***
α_8	$GDPGrowth_t$	-0.014 (0.0200)	0.329 (0.0272)***
α_9	*Manufacturing sector*	0.037 (0.0831)	0.456 (0.0735)***
α_{10}	*R&D sector*	-0.184 (0.0940)*	0.151 (0.0808)*
α_{11}	*Software sector*	0.452 (0.0691)***	0.084 (0.0700)
	Second Transitions		
β_A	$GG \rightarrow VC$	-0.110 (0.1828)	-
β_B	$VC \rightarrow GG$	-	-0.387 (0.1694)**

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,526 and number of observations is 8,093.

Table 10 Number of investors, number of deals, average and maximum number of deals implemented with equity issuance and GG lending in the sample YICs from 2009 to 2016

Type of investor	Number of investors	Total number of deals	Mean	Max
Venture Capital	116	276	1.57	18
Bank	101	418	2.58	44

Table 11 Characteristics of investors and number of deals: random effects panel data estimates. The dependent variables are (i) $Loans_t$ (the number of GG loans granted by each bank in the sample YICs during year *t*), (ii) $VC\ Investments_t$ (the number of equity investments made by professional VCs in the sample YICs during year *t*)

	Analysis type	Random effects	Random effects
	Dependent Variable	$Loans_t$	$VC\ Investments_t$
α_{const}	*Constant*	-2.215 (1.4387)	1.808 (0.2341)***
β_1	$LnConsAsset_t$	0.520 (0.1415)***	-
β_2	$LnAUM_t$	-	0.049 (0.0878)
β_3	*Foreign Headquarter*	-	-0.814 (0.5051)
β_4	*International Branch*	-1.149 (1.0490)	-
β_5	*Local Bank*	-0.280 (0.5287)	-
β_6	*Startup Program*	4.909 (1.0886)***	-

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of observations is 164 for Loans and 148 for VC Investments.

Table 12 Determinants of YICs' performance: panel data random effects model. The dependent variables are: (i) $LnSales_t$ which is the logarithm of the total annual sales of firm *i* during year *t*, (ii) $TotEmployees_t$, the number of employees reported by firm *i* at the end of year *t*.

Analysis type	Random effects	
Dependent Variable	$LnSales_t$	$TotEmployees_t$
Constant	6.737 (2.2458)***	-0.498 (1.669)
VC_{t-1}	1.302 (0.2455)***	2.736 (0.218)***
GG_{t-1}	0.184 (0.2683)	0.932 (0.250)***
Age_t	0.470 (0.0519)***	0.515 (0.043)***
$Leverage_{t-1}$	0.490 (0.0585)***	0.215 (0.052)***
ROA_{t-1}	0.971 (0.1512)***	0.430 (0.131)***
DSouth	-0.703 (0.3682)*	0.794 (0.259)***
Industrial Intensity	0.102 (0.1874)	0.123 (0.133)
Value Added	-0.023 (0.0177)	0.023 (0.013)*
Infrastructure	0.003 (0.0039)	-0.002 (0.003)
$Deficit/GDP_t$	0.140 (0.2347)	0.440 (0.239)*
$GDPGrowth_t$	-0.017 (0.0376)	0.052 (0.041)
Manufacturing sector	-0.734 (0.2648)***	0.243 (0.192)
R&D sector	-1.567 (0.2722)***	-0.442 (0.198)**
Software sector	-0.189 (0.2280)	0.579 (0.165)***

Legend: * p < .10; ** p < .05; *** p < .01. All two-tailed tests. Robust standard errors in parentheses. Number of firms is 2,195, with 4,748 observations for $LnSales_t$ equation and 2,402 (4,984 observations) for $TotEmployees_t$ equation.

Appendix

Table A1 Correlation matrix of the explanatory variables. * p < .10; ** p < .05; *** p < .01. All two-tailed tests

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*
(1) $DSeed_t$	1															
(2) Age_t	-0.635***	1														
(3) $Employees_{t-1}$	-0.223***	0.317***	1													
(4) $LnTotAsset_{t-1}$	-0.969***	0.688***	0.325***	1												
(5) $N\_Manager_t$	-0.099***	0.139***	0.185***	0.156***	1											
(6) $Leverage_{t-1}$	-0.505***	0.376***	0.200***	0.546***	-0.014	1										
(7) ROA_{t-1}	0.136***	-0.066***	-0.031***	-0.076***	-0.027**	0.020	1									
(8) Dsouth	0.019*	-0.001	0.036***	-0.041***	-0.077***	-0.074***	0.009	1								
(9) Industrial Intensity	-0.013	0.010	-0.022*	0.013	0.002	0.026**	0.030***	-0.350***	1							
(10) Value Added	0.010	-0.048***	0.001	0.008	0.059***	0.031***	-0.052***	-0.369***	-0.359***	1						
(11) Infrastructure	-0.015	0.014	-0.027**	0.021*	0.052***	0.010	0.002	-0.392***	-0.235***	0.141***	1					
(12) $Deficit/GDP_t$	-0.449***	0.350***	0.138***	0.432***	-0.048***	0.252***	-0.095***	0.021*	-0.011	0.019*	-0.014	1				
(13) $GDPGrowth_t$	-0.264***	0.262***	0.086***	0.248***	-0.018	0.150***	-0.085***	0.019*	-0.019*	0.008	-0.017	0.151***	1			
(14) Manufacturing sector	-0.017	0.031***	0.022*	0.047	0.044***	0.074***	0.025**	-0.019*	0.085***	-0.080***	-0.035***	-0.035***	-0.004	1		
(15) R&D sector	-0.006	0.023**	-0.063***	0.004***	0.040***	-0.039***	0.056***	0.008	0.002	-0.049***	0.033***	-0.021*	0.013	-0.236***	1	
(16) Software sector	0.021*	-0.061***	0.039***	-0.039	-0.046***	-0.040	-0.076***	0.020*	-0.059***	0.056***	-0.005	0.046***	0.010	-0.410***	-0.370***	1

Table A2 Definition of entrepreneurs' human capital variables

Variable	Description and source
Human Capital-specific	
Technical Education	Average years of founders' scientific and/or technical education at graduate and post-graduate level (source: *Telemaco and LinkedIn*)
Economic Education	Average years of founders' economic and/or managerial education at graduate and post-graduate level (source: *Telemaco and LinkedIn*)
Managerial Experience	Average years of founders' managerial experience (source: *Telemaco and LinkedIn*)
Sector Work Experience	Average years of founders' work experience in the same sector of the firm before foundation (source: *Telemaco and LinkedIn*)
Generic Work Experience	Average years of founders' work experience in other sectors before firm's foundation (source: *Telemaco and LinkedIn*)

Table A3 Descriptive statistics for entrepreneurs' human capital variables

Variable	Mean	Stand. Dev.	Max	Min
Technical Education	6.142	10.952	74.000	0.000
Economic Education	1.712	5.060	75.000	0.000
Managerial Experience	1.688	3.476	28.000	0.000
Sector Work Experience	3.102	5.037	38.000	0.000
Generic Work Experience	1.236	3.237	40.000	0.000